



Exploring

ANIMAL SCIENCE



Frank B. Flanders



Exploring
ANIMAL
SCIENCE



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Frank B. Flanders



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Library of Congress Control Number: 2011920522

ISBN-13: 978-1-4354-3952-8

ISBN-10: 1-4354-3952-X

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5 Maxwell Drive

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*To my mother, Saradene Claxton Flanders:
You had a greater impact on my life than you
will ever know. Thank you for your love and
encouragement.*

— Frank B. Flanders

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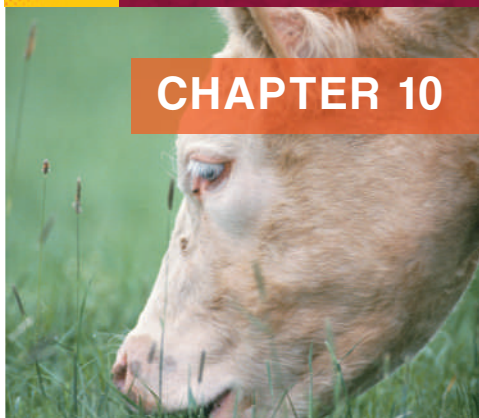
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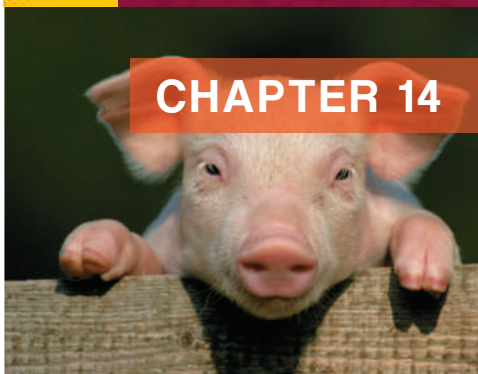
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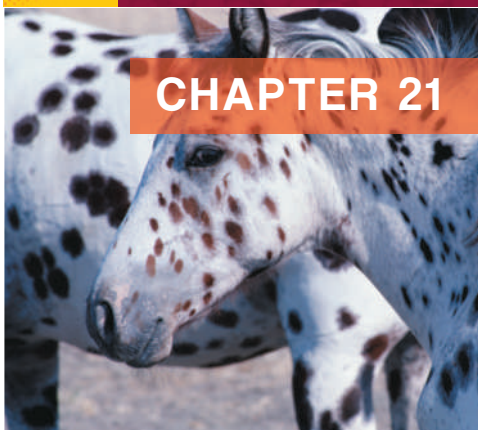
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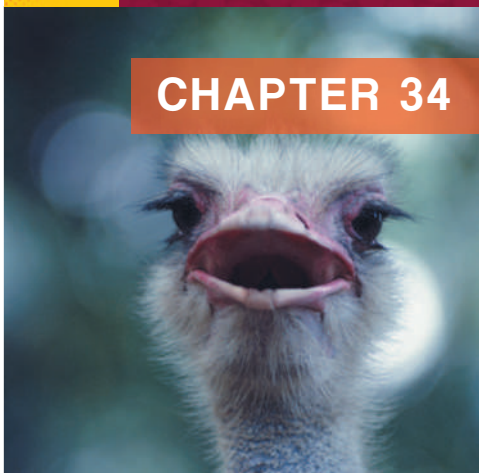
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The header features a decorative background on the left with orange and pink polka dots. On the right, there is a photograph of a group of sheep with thick, light-brown wool, some wearing yellow ear tags. The word "Preface" is written in white serif font on a brown rectangular background that spans the width of the page.

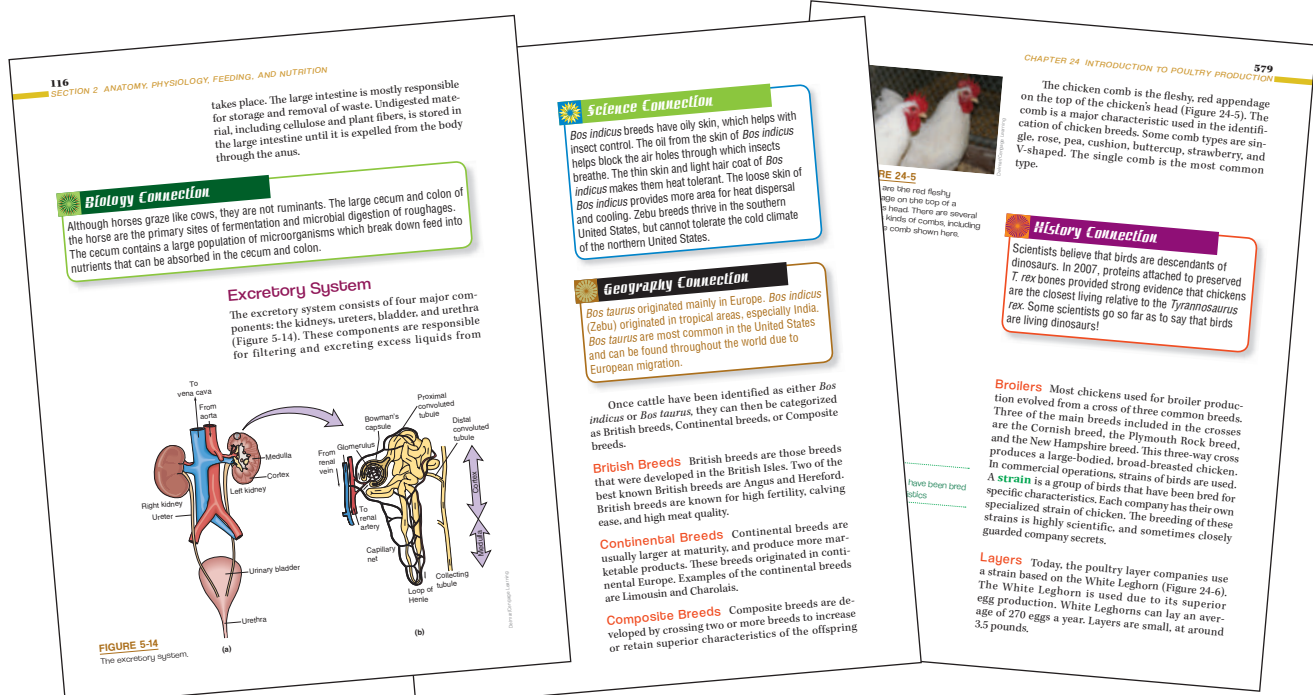
Preface

Exploring Animal Science is designed for use in introductory animal science courses at the middle school and early high school levels. It emphasizes readability, organization, and practical applications in animal science. This text includes traditional livestock and poultry as well as exotic animals, such as rabbits, large game animals, ratites, game birds, llamas, and alpacas, and companion animals, such as dogs and cats. By integrating the study of exotic and companion animals with livestock and poultry, this text presents ideas that can be related to both traditional and non-traditional animal science students. The text is based on the most up-to-date information available and is applicable to all areas of the United States.

Section 1 includes an overview of the animal science industry- its history, the career opportunities available, safety and biosecurity, and environmental concerns. Section 2 introduces the concepts of anatomy, physiology, nutrition, and feeding as they apply to the study of animal science. Section 3 is centered on animal reproduction with information regarding genetics, biotechnology, and different animal breeding systems. Sections 4, 5, 6, and 9 detail the production, management, selection, judging, fitting, and showing aspects of beef cattle, swine, sheep and goats, and dairy cattle respectively. Section 7 discusses the management and training associated with horses. Section 8 includes an overview of the poultry industry. Sections 10 and 11 contain overviews of companion and exotic animals.

Key Features

- ◀ **FFA and 4-H Activities** – A listing of various FFA and 4-H activities that are related to the material presented in the chapter. Students should contact their local FFA and/or 4-H chapter if they wish to participate.
- ◀ **Objectives** – A list of concepts students should have an understanding of after the completion of the chapter.
- ◀ **Integrated Learning** – Numerous boxed elements tie animal science concepts to other core knowledge areas.
 - ◀ **Science Connection** – highlights how concepts are related to scientific research and discovery
 - ◀ **Geography Connection** – highlights relationships between issues and practices that are global in nature
 - ◀ **History Connection** – highlights historical events related to animal science and animal production systems
 - ◀ **Biology Connection** – highlights links between current practices and concepts to biological sciences and discoveries



- ▶ **Math Connection** – highlights the importance of using math in common practice in the animal industry
- ▶ **Health Connection** – highlights the relationships between animal science and the impact on the health of society as a whole
- ▶ **Language Connection** – highlights the links between English and other common languages used throughout the world

CHAPTER 16 SELECTING AND JUDGING SWINE 371

Health Connection

THE COOK'S BEST FRIEND

Before about 1950, fat hogs were highly prized. Hog fat was rendered into lard, which has a number of qualities that made it ideal for frying and cooking all manner of foods. Due to its high saturated fat content, lard has fallen out of favor for health reasons, being replaced with vegetable oils, peanut oil, canola oil, olive oil, etc.

Symbol III
the NPPC designation for the ideal market hog

The National Pork Producers Council (NPPC) describes the ideal market hog as **Symbol III** (Figure 16-4). The ideal market hog has correctness of structure, production, performance, function, livability, attitude, health, and optimum lean yield. Symbol III also produces the best quality and safest pork that provides the optimum nutrients for human nutrition. Symbol III represents the model pig that swine farmers strive to produce.

FIGURE 16-4
Symbol III is an ideal market hog. The ideal market hog has correctness of structure, production, performance, function, livability, attitude, health, and optimum lean yield.

CHAPTER 21 INTRODUCTION TO HORSES 503

Breeds of Ponies

Of the only physical distinction between horses and ponies. Ponies are smaller than horses, usually standing less than 14.2 hands high. A hand is a unit of measurement of a horse's height, based on the width of the pastern, which is 4 inches (10.16 cm). The height of a pony or horse is taken at the withers. The withers of the horse are the highest part of the horse's back, located at the base of the neck where the top of the shoulder blades come together. Other differences between ponies and horses are **phenotype** and temperament. Ponies often exhibit thicker manes, tails, and coats. They also have proportionally shorter legs, wider bodies, heavier bone structure, shorter and thicker necks, and short heads with broad foreheads. There are about 65 individual breeds of ponies. Table 21-1 lists some of the more commonly known breeds. A few of the most popular ponies will be discussed here.

Math Connection

If you have a horse that is 15.2 hands high, the 15 equals the number of hands and the 2 is the extra inches. How tall, in inches, is a horse that is 15.2 hands? 16.2? 14.3? 17.1?

(15.2 hands = 62 inches; 16.2 hands = 66 inches; 14.3 hands = 59 inches; 17.1 hands = 69 inches)

TABLE 21-1
Common Pony Breeds

American Walking Pony	Chincoteague Pony
Connemara Pony	Hackney Pony
Hartfing Pony	Pony of the Americas (POA)
Shetland Pony	Welsh Pony
Dales	Fell
Dartmoor	Highland or Gairn
New Forest	Norwegian Fjord

SECTION 4 BEEF CATTLE 206

LANGUAGE CONNECTION

English	Swedish	German	Italian	Spanish
Beef	Sköf	Heubisch	Miscio	El Carne de Res
Hereford	Härdford	Vierhöf	Hereford	La Hereford
Registered	Inscrit	Eingetragt	Registrato	Registrado
Composite	Composito	Composit	Composito	Composito
Continental	Continental	Kontinental	Continental	Continental
British	Britannic	Britisch	Britannico	Británico
Maternal	Maternel	Mütterliche	Materno	Materno
Paternal	Paternel	Väterlich	Paterno	Paterno

Overview of the Beef Industry

Beef production in the United States is a highly efficient industry. The United States produces nearly 25 percent of the world's beef even though it only has 10 percent of the world's cattle. The beef cattle industry is the single largest segment of American agriculture. In the United States, 38 percent of total income from all livestock and poultry comes from the beef industry.

Most beef consumed in the United States is **domestically** produced. Exportation of beef varies by year, but averages about 5.75 percent of total U.S. production (Figure 10-1). However, beef imports

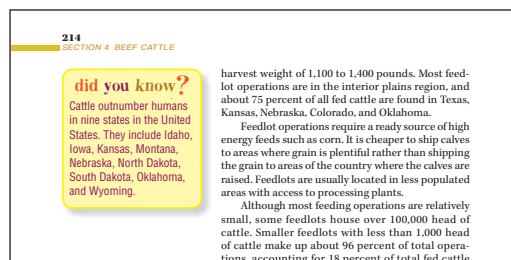
FIGURE 10-1
U.S. beef exports vary by year, but average 5.75 percent of total production.

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SECTION 4 BEEF CATTLE

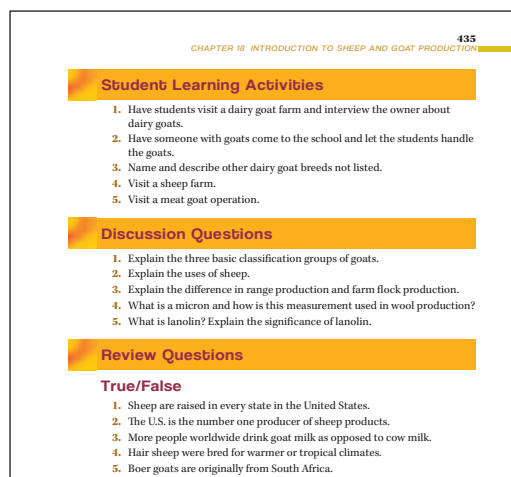
Quick Facts

- The beef cattle production industry is the single largest segment of American agriculture.
- Consumption of beef is affected by beef supply, price, the number of consumers, income of the consumers, and dietary trends.
- The United States produces 25 percent of the world's beef supply with only 10 percent of the world's cattle.
- The four main types of beef production operations are purebred breeders, cow-calf, stocker, and feedlot operations.
- A breed is developed over many generations by selecting animals with desirable traits to keep for breeding, and culling animals with undesirable traits.
- Cattle breeds are one of two species, *Bos taurus* or *Bos indicus*.
- Beef breeds are further classified as British, Continental, or Composite breeds.
- *Bos taurus* are generally of European descent and include the Texas Longhorn, Angus, Shorthorn, Hereford, Simmental, Limousin, Charolais, Gelbvieh, Maine-Anjou, and Chianina.
- *Bos indicus* include the Brahman breed. They are also known as "humped" cattle. *Bos indicus* originated in tropical areas. They are well-suited to hot and humid climates.
- Many breeds have *Bos indicus* or Brahman influence, including, Brangus, Santa Gertrudis, and Beefmaster.
- Beefmaster, Brahman, Brangus, Red Angus, Santa Gertrudis, and Texas Longhorn breeds were developed in the United States.
- Breeds are maintained by breed associations which require registration and verification of a purebred.

- ▶ **Ease of Learning** – Key terminology is an important part of comprehension. Glossary terms are highlighted and defined in the text margins for ease of location and studying. Each chapter ends with "Quick Facts" that highlights key concepts in the chapter in a short and concise format perfect for use as a study tool.



◀ **Making it Fun** – Did You Know is a boxed element that provides fun insights into the various topics discussed.



◀ **Recall and Apply** – End of chapter questions and exercises allow students to test their knowledge of what they learned as well as apply that knowledge through various suggested projects or assignments. *Student Learning Activities* provides a list of hands-on activities designed to encourage and promote the study of animal science outside of the classroom. Discussion, multiple choice, matching, and true/false questions are presented to help students review the material presented in the chapter, while also serving as a possible assessment.

Extensive Teaching and Learning Package

The complete supplement package was developed to achieve two goals:

1. To assist students in learning the essential information needed to continue their exploration in the field of animal science.
2. To assist instructors in planning and implementing their instructional program for the most efficient use of time and other resources.

Instructor Supplements

Exploring Animal Science Classroom Interactivity CD

ISBN: 1-4354-3962-7

This tool allows instructors to create a dynamic learning environment while engaging their students in active participation.

The CD-ROM contains four different “game show themed” applications to be run by the instructor. All questions are taken directly from the readings of the text and serve as great tools in reinforcing the main concepts of each chapter.

Exploring Animal Science ClassMaster CD-ROM

ISBN: 1-4354-3954-6

This CD-ROM provides the instructor with valuable resources to simplify the planning and implementation of the instructional program. It includes answers to questions in the text, lesson plans, a computerized testbank, and instructor presentations on PowerPoint™. These resources combine to provide a cohesive plan for presenting each topic.

Exploring Animal Science Instructor's Manual

ISBN: 1-4354-3953-8

The *Instructor's Guide for Exploring Animal Science* contains complete answers to each end of the chapter question presented in the text.

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ISBN: 1-4354-3959-7

This resource reinforces text content. It is recommended that students complete corresponding lab components to confirm understanding of essential skills and applied concepts.

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ISBN: 1-4354-3961-9

The Laboratory Manual is also available on CD-ROM. This allows instructor's to print as many copies of the exercises as needed, for as long as they own the book.

Exploring Animal Science Laboratory Manual Instructor's Manual

ISBN: 1-4354-3960-0

This resource provides answers to the lab manual exercises and additional guidance for the instructor.

About the Author



Dr. Frank B. Flanders has extensive experience in developing agriculture education teaching materials. He received his Bachelor's, Master's, and Doctoral degrees from the University of Georgia and has served agriculture education for over 32 years. He has taught high school agriculture education and was a Special Instructor in Agricultural Education at the University of Georgia for 15 years. He served as the Agriculture Education Curriculum Coordinator in Georgia for 11 years. As Curriculum Coordinator, he developed and maintained the Georgia Agricultural Education website, produced instructional DVDs and CDs for teachers, managed curriculum projects, and taught numerous workshops for teachers. He has served as the Career, Technical, and Agricultural Education Resource Network Curriculum Coordinator for three years. Dr. Flanders currently serves as an Assistant Professor of Agriculture Education at the University of Georgia. He is the ninth generation of his family to be actively involved in American agriculture. Dr. Flanders was inducted into the Georgia Agriculture Education Hall of Fame in 2003 and received the National Outstanding Faculty Advisor Award from the Professional Fraternity Association. He has also received the Outstanding Faculty Member in Agriculture Education Award and the Outstanding Service and Faculty Member Award from the University of Georgia Student Government Association.

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Acknowledgments



Special thanks are extended to the following professionals for their expertise, advice, photos, encouragement, and help on this project: Dr. Ray V. Herren, Raymond Fitzpatrick, Evan Clark, Tommy Waldrop, Shannon Lawrence, and Christa Steinkamp.

Also, many thanks to University of Georgia students Alyssa Elrod, Mark Smith, Amanda Stephens, Juliane Monko, Kayla Calhoun, Christy Bryan, Whitney Kizer, Randy Glance, Cate Buchanan, and Melissa Snyder for their hard work and dedication put into proofing, finding photographs, and assistance in assembling materials. Thank you to Delmar Cengage editor Darcy M. Scelsi for her kind assistance and especially for her patience. Thank you to my family for their acceptance of my long hours from home: my wife Karen Flanders, and children Jason, Matthew, Melody, Macy, and Christopher.

Frank B. Flanders

Reviewers

Amy New
Dacusville Middle School
Easley, South Carolina
Pickens Middle School
Pickens, South Carolina

Andrea Adams
Sebring Middle School
Sebring, Florida

Joanna Marsh
Cypress Lakes High School
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Christiansburg Middle School
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Michelle Meier
Lodi Middle/High School
Lodi, Wisconsin

Paul Lucas
Ligon Middle School
Raleigh, North Carolina

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Section 1

OVERVIEW OF THE ANIMAL SCIENCE INDUSTRY

- CHAPTER 1 The Animal Science Industry
- CHAPTER 2 Career Opportunities in Animal Science
- CHAPTER 3 Safety and Biosecurity
- CHAPTER 4 Animal Science and the Environment

FFA AND 4-H CONNECTION



The following is a partial list of activities in which a student may participate using knowledge obtained in a livestock or companion animal program. Students should consult local and state youth organizations, such as the National FFA Organization and 4-H, to determine livestock-related programs available in their area.

- **Agricultural Marketing**
- **Agricultural Sales**
- **Agriscience Fair**
- **Animal Nutrition**
- **Food Science and Technology**
- **Junior Livestock Shows**
- **Livestock Evaluation**
- **Meats Evaluation and Technology**

Proficiency Awards (FFA)

- **Diversified Agricultural Production**
- **Diversified Livestock Production**
- **Livestock Production**
- **Specialty Animal Production**
- **Veterinary Medicine**





CHAPTER 1

The Animal Science Industry



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Discuss the history of the domestication of animals.
- List and explain the uses of domestic animals.
- Describe the animal industry in the United States.
- Identify trends in the animal industry.



KEY TERMS

animal science
domestic
by-product
livestock
exotic animal
companion
animal
captive animal

domestication
breed
Bos taurus
Bos indicus
Sus scrofa
Sus vittatus
Eohippus
draft animal

Gallus gallus
homeothermic
species
non-ruminant
ruminant
rumen
hybrid pet
animal welfare

LANGUAGE CONNECTION

English	French	Spanish	German	Latin
Domestication	Domestication	La Domesticación	Domestikation	Domesticus
Breeds	Races	Las Razas	Rassen	N/A
Cattle	Bovins	El Ganado	Rindvieh	Pecus
Swine	Pourceau	El Cerdo	Schwein	Porcus
Sheep	Mouton	La Oveja	Schaf	Ovis
Goat	Chèvre	La Cabra	Ziege	Capra
Horse	Cheval	El Caballo	Pferd	Equus
Chicken	Poulet	El Pollo	Huhn	Pullus

animal science

the scientific study of animals for work, food, medicine, companionship, and other consumer goods

domestic

an animal living in close proximity to humans; an animal that is tame

Animal Science

The **animal science** industry is tremendously important to the economy of the United States. Animal science includes the production, use, and care of animals (Figure 1-1). Historically, animal science implied the study of farm animals. Today, the study of animal science covers all **domestic** animals including livestock, poultry, companion animals, and captive animals, such as those found in zoos.

FIGURE 1-1

Modern animal science uses a variety of computer technologies to help producers remain competitive.



by-product

animal parts used in a manner that is secondary to the intended or original use

livestock

animals raised and bred for commercial use or pleasure

exotic animal

an animal that is not traditionally raised as a production or companion animal

companion animal

animals kept for pleasure and entertainment

captive animal

animals kept in zoos or wild animal parks

Animals affect the lives of almost every human in some way. People are dependent upon animals for food and clothing, as well as companionship and labor. Animals are also used in medical research. Animal **by-products** are used as ingredients in an array of consumer products from insecticides to cosmetics.

Animal science topics of study include animal breeds and breeding, nutrition, health care, anatomy and physiology, genetics, growth, training, housing, behavior, and welfare. The field of animal science research seeks to determine how these processes may be used for improved animal performance and productivity.

Livestock production and poultry production are the most important industries within animal science (Figure 1-2). Production of livestock and poultry involves the science and business of producing, processing, and marketing of meat, dairy foods, eggs, and animal by-products. The production of livestock and poultry involves selection, breeding, feeding, training, care, and marketing of animals. Large animals used for work and pleasure, such as horses, are also considered livestock.

Exotic animals are non-traditional livestock and poultry animals used for the production of food and fiber (Figure 1-3). Examples of exotic animals are bison, llamas, ostriches, and quail. Exotic animals are a small part of the total animal industry, but are still important sources of income for many producers.

Companion animals include cats, dogs, and other animals kept for pleasure and entertainment (Figure 1-4). Exotic pets such as reptiles, amphibians, and birds are also becoming popular companion animals. Animal science includes the nutrition, care, and welfare of companion animals.

Captive animals include non-domestic animals such as tigers, deer, raccoons, and other wildlife kept in zoos and private parks.



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Courtesy of Amanda Stephens



Courtesy of Billy Moss



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Courtesy of Shannon R. Lawrence



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FIGURE 1-2

The largest sector of animal science is the livestock and poultry industries. (A) Dairy cows are raised for milk production. (B) Sheep are raised for wool and meat. (C) Pigs are raised for meat. (D and E) Goats are raised for milk and meat. (F) Beef cattle are raised for meat. (G) Turkeys are raised for meat. (H) Chickens are raised for eggs and meat.



Courtesy of Shannon Lawrence



Courtesy of the Fish and Wildlife Service



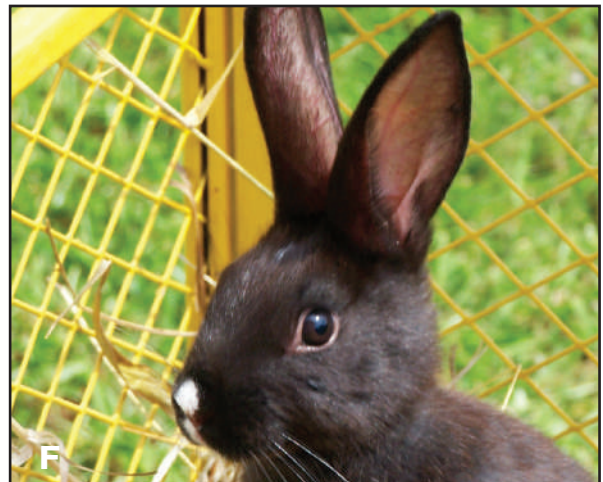
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Courtesy of USDA



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Courtesy of Caleb Allred

FIGURE 1-3

Exotic animals include: (A) llamas (B) ratites (C) bison (D) waterfowl (ducks) (E) large game animals such as deer (F) rabbits.



Courtesy of J. Simpson



Courtesy of Shannon R. Lawrence



Courtesy of Cate Buchanan



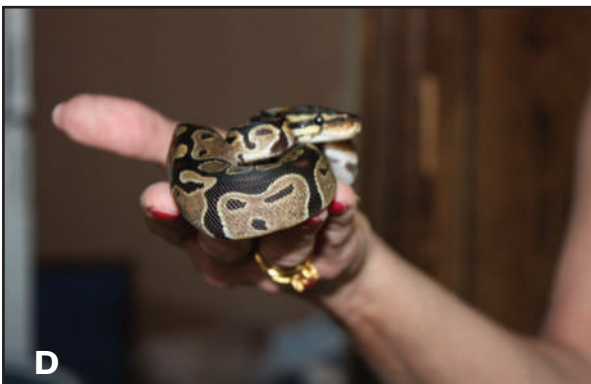
Courtesy of Shannon R. Lawrence



Courtesy of Shannon R. Lawrence



Courtesy of Shannon R. Lawrence



Courtesy of Shannon R. Lawrence



Courtesy of Shannon R. Lawrence

FIGURE 1-4

Companion animals include: (A) dogs (B) horses (C) cats (D) snakes (E) guinea pigs (F) birds (G) fish (H) reptiles.

The Animal Science Industry

The scope of the animal industry extends far beyond the farm. Up to eighteen percent of U.S. jobs are directly related to agriculture, with many of them in animal agriculture. For example, by-products of the meat industry are used to produce pet foods. In fact, United States citizens spend more money annually on cat and dog food than on baby food. The animal industry includes the manufacturing of products such as feed and feed additives, biological compounds, and pharmaceuticals (Figure 1-5).

Equipment, supplies, feeds, tools, and related items for animals are big business. Equipment for animals includes products ranging from simple collars and leashes to complex machinery, such as handicapped animal wheelchairs and underground fencing.

Feed additives are those products used in livestock, poultry, and pet animal products to control or prevent disease, enhance growth, or improve feed efficiency.

Biological products and pharmaceuticals include vaccines, bacterins, and antitoxins. Biologically, humans are quite similar to some animals. This makes animal research an important aspect of developing

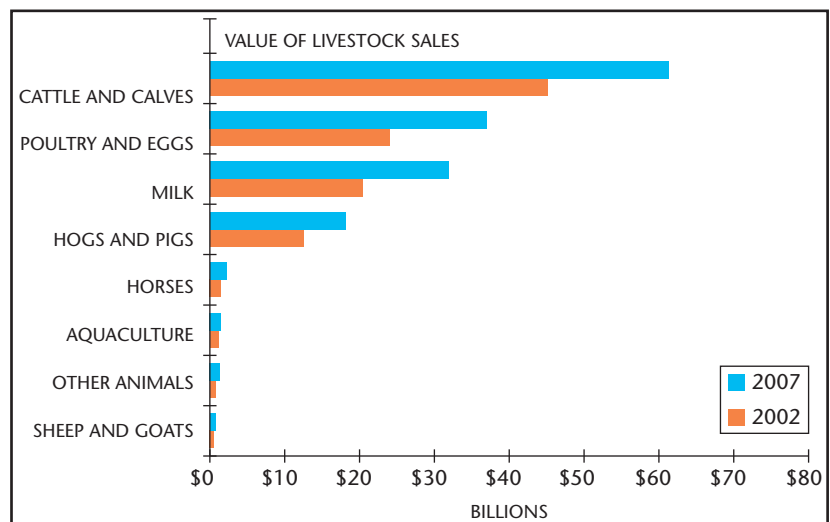


FIGURE 1-5

Animal agriculture produces billions of dollars each year.

new medicines and medical procedures. Biotechnology is developing because of animal research. Surgeons often use animal organs in place of damaged human organs.



Science Connection

The valves of a pig's heart are commonly implanted into humans with damaged hearts. This is known as xenotransplantation – the transplantation of tissues from one species to another. Other than primates such as the chimpanzee, pigs are the biologically closest animal to humans.

Pharmaceutical products from animals are used as medicines for disease control and disease prevention in both humans and other animals. One of these medications is insulin used in the treatment of diabetes in humans. Insulin was once extracted from cows and pigs that were being harvested. Insulin is made in the pancreas, so great care was taken to deliver these organs unharmed to medical companies. Companies that produce animal health products spend millions of dollars on research and development of new products.

Table 1-1 shows the ten leading states in several categories of livestock and livestock products production. It also shows the ten leading states in cash receipts from livestock. The ranking of the states shown in the table may change from year to year.

Domestication of Animals

domestication

bringing animals under the control of humans

The **domestication** of animals was one of the great events in human history. With the domestication of animals came the beginnings of a more settled way of life. Captive animals helped ensure a steady food supply. People were no longer forced to roam great distances in search of food. The domestication of animals began when early humans made contact with wild animals (Figure 1-6). Some of the animals were captured and confined for short periods until they were needed for food. Companion animals, such as dogs,

TABLE 1-1

Leading States in Livestock and Livestock Product Production

Beef Cattle and Calves	Fed Cattle Marketed	Swine	Dairy Cattle	Sheep and Lambs	Wool	Chickens (Including Commercial Broilers)	Eggs	Broilers	Turkeys	Leading States in Cash Receipts from Livestock
Texas	Texas	Iowa	California	Texas	Texas	Iowa	Iowa	Georgia	Minnesota	Texas
Nebraska	Kansas	North Carolina	Wisconsin	California	Wyoming	Ohio	Ohio	Arkansas	North Carolina	California
Kansas	Nebraska	Minnesota	New York	Wyoming	California	Pennsylvania	Indiana	Alabama	Missouri	Iowa
Colorado	Oklahoma	Illinois	Pennsylvania	South Dakota	Colorado	Indiana	Pennsylvania	North Carolina	Arkansas	Nebraska
Oklahoma	Colorado	Indiana	Minnesota	Colorado	South Dakota	California	California	Mississippi	Virginia	Kansas
Iowa	Iowa	Nebraska	Idaho	Montana	Montana	Georgia	Georgia	Texas	Indiana	North Carolina
South Dakota	California	Oklahoma	New Mexico	Idaho	Utah	Texas	Texas	Delaware	California	Wisconsin
California	South Dakota	Missouri	Texas	Utah	Idaho	Arkansas	Arkansas	Kentucky	Iowa	Minnesota
Missouri	Montana	Ohio	Michigan	Iowa	Iowa	Nebraska	Nebraska	Virginia	South Carolina	Arkansas
Montana	Idaho	Kansas	Ohio	Oregon	Oregon	Minnesota	Florida	Maryland	Pennsylvania	Oklahoma

Source: USDA, 2005.

FIGURE 1-6

Animals have played an integral role in human existence.



©iStockphoto/Jan Derksen

breed

closely related groups of animals that share similar characteristics as a result of the breeding process

Bos taurus

a type of cattle originating in Europe and the British Isles

Bos indicus

a type of cattle originating in India and Africa

were domesticated when they accepted food from humans, and in return, provided guard services, assistance with hunting, and companionship. Eventually, the animals were bred in captivity, and their offspring became more docile with each successive generation. **Breeds** eventually developed as humans selected animals with the most desirable characteristics.

Cattle

Modern cattle are descendants of both *Bos taurus* and *Bos indicus*. *Bos taurus* cattle originated in Europe and the British Isles (Figure 1-7). *Bos indicus* are the humped Zebu cattle originating in India and Africa (Figure 1-8). *Bos indicus* are common throughout the United States, especially in the South where their resistance to some diseases, parasites, and heat is an advantage.

Cattle are mentioned in records at least 4,000 years old. Christopher Columbus brought the first cattle to the New World on his second voyage in 1493. Descendants of these cattle were brought to the United States from Mexico in 1521. Texas Longhorns are direct descendants of these cattle. The English brought large numbers of cattle to the United States beginning with the founding of Jamestown colony in Virginia in 1611. Early settlers took cattle with them as they moved westward. From the settlement of the Americas until



Courtesy of Billy Moss

FIGURE 1-7

Most *Bos taurus* cattle breeds originated in Europe.



Courtesy of American Brahman Breeders Association

FIGURE 1-8

The Brahman is the most familiar breed of *Bos indicus*, having excess skin and a characteristic hump.

about the 1950s, most farms included cattle, especially milk cows that provided fresh milk and butter.

Sus scrofa

European wild boar

Sus vittatus

East Indian pig



Courtesy of Randy Glance

FIGURE 1-9

The European wild boar (*Sus scrofa*) is an ancestor to the pigs of today.

Swine

Modern breeds of swine were derived from the European wild boar (*Sus scrofa*) (Figure 1-9) and the East Indian pig (*Sus vittatus*). Over 30 breeds are common in the United States today, although only about 8 contribute significantly to commercial production. The first people to domesticate swine were the Chinese about 4900 BC. Records mention swine production in Great Britain around 800 BC. Swine were first brought to the New World by Columbus on his second voyage in 1493. More swine were brought later by Spanish explorers. Later, English settlers exported pork and lard. The main expansion of the swine industry in the U.S. occurred in the Corn Belt states, a region of the midwest where corn is produced in large amounts.



History Connection

When most Americans hear the word “truffles,” they think of a round chocolate treat, but in truth, truffles are edible fungi that grow underground. Truffles are one of the most expensive foods in the world, sometimes bringing a price of \$1000 per pound. In Europe, female pigs are used to find these expensive treasures because the mature truffle gives off the same pheromones as the male pig’s sex pheromones.



Courtesy of Amanda Stephens

FIGURE 1-10

Sheep and goats were the first livestock animals to be domesticated.

Sheep

Sheep were among the first domesticated animals (Figure 1-10). Sheep have long been used for fiber, meat, and milk. Sheep are shown on Egyptian sculptures dated about 4000 BC and are mentioned in the earlier passages of the Bible. Sheep were used by the early people of Europe as well. Spain and England were major sheep-producing areas. Columbus brought sheep to the New World on his second voyage in 1493. British breeds were imported to Virginia in 1609. Sheep were used by the early colonists mainly for wool production that was made into clothing. By the early 1800s, the northeastern part of the United States was the main sheep-producing center of the U.S., although sheep were common across the country. Sheep production gradually moved westward because of an abundance of grazing land, and the center of the sheep-producing industry is now in the western United States.



History Connection

During early flight and throughout the First World War, pilots rode in open cockpits. Military clothing was not adequate to help keep the pilots warm. Leather jackets made from the hides of sheep, having a lining and collars made of fleece, fit the bill. Later, and especially in World War II, these jackets would adopt the name “Bomber Jackets.”



Delmar/Cengage Learning

FIGURE 1-11

Goats, like sheep, provide food, milk, and fiber for humans.

Goats

Goats, along with sheep, are thought to be one of the first domesticated livestock species in the world. The goat is believed to be descended from wild goats found in Asia Minor, Persia, and other countries (Figure 1-11). Goat remains have been found in the Swiss Lake villages of the Neolithic Age. The Bible refers to the use of mohair from goats.

Christopher Columbus first brought goats to the New World on his second voyage. Goats are considered multi-purpose animals because they can be used

for milk, fiber, and meat. Milk goats were brought to Virginia and the New England states by the early settlers. Most of the increase in milk goat numbers in the U.S. has occurred since 1900. Milk goats are raised throughout the United States, mostly on small farms, but there are a few large herds of milk goats.

Horses

Horses evolved from a tiny four-toed ancestor called **Eohippus**. Eohippus was approximately one foot tall and lived in swamps about 58 million years ago (Figure 1-12). Eohippus was native to North America, but disappeared entirely before Europeans settled the New World.

There were no horses in the New World when Columbus arrived. The first domestication of the horse was probably in Central Asia or Persia before 3000 BC. The use of the horse spread from there into Europe. Columbus brought horses to the New World on his second voyage in 1493. The Spanish explorers brought horses with them to North America. In 1519, Cortez imported horses into Mexico. Wild horses found on western ranges are the descendants of these Spanish horses.

Eohippus

an early ancestor of the domestic horse

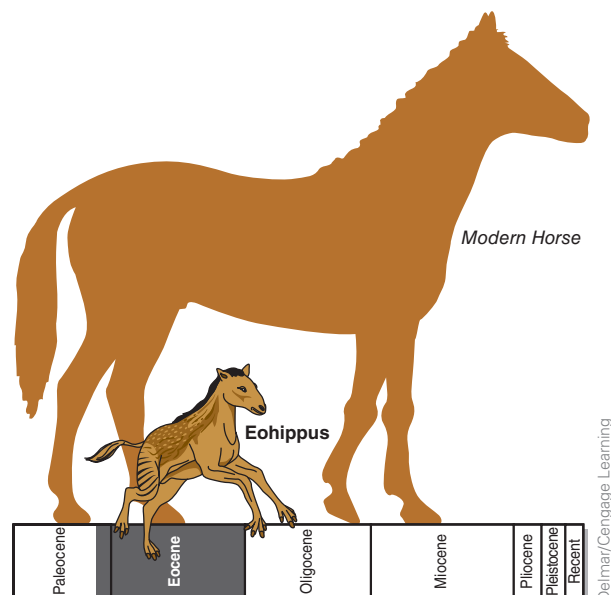


FIGURE 1-12

Eohippus, the horse ancestor, was native to North America. Eohippus lived about 58 million years ago.



Courtesy of Cate Buchanan

FIGURE 1-13

The horses of today barely resemble Eohippus, their first ancestor.

draft animal

an animal that is used for pulling loads

Saddle horses and draft horses were brought to the United States by the early colonists. For many years, oxen were used as the main **draft animal** of the colonists. Later, mules and horses were used as draft animals. Horses served mainly as pack animals and for riding, whereas mules provided power for plowing and pulling wagons. Heavier draft horses used for work were brought to the colonies by Dutch, Puritan, and Quaker settlers. Most horses in the United States today are used for riding and racing (Figure 1-13).

Poultry

The chicken has been domesticated for at least 3500 years. The Chinese were raising chickens as early as 1400 B.C. However, the modern system of poultry and egg farming is relatively new, developing in the early 1900s. Poultry has only recently become a



Courtesy of Randy Glance

FIGURE 1-14

The wild jungle fowl of India (*Gallus gallus*) is the ancestor to most domestic chickens of today.

Gallus gallus

a wild jungle fowl that originated in India

major commercial enterprise, which utilizes large confinement housing. Much of the poultry industry, especially broiler production, is concentrated in the southern part of the United States.

The wild jungle fowl of India (*Gallus gallus*) (Figure 1-14) is thought to be the ancestor of most domestic chickens. Other wild species may also have been involved in the development of chickens.

The American poultry industry grew out of the small home flocks raised by early settlers. Before 1900, raising poultry was mainly a small enterprise on the farm. However, as the U.S. population grew and became more urbanized, it was not feasible for individuals to produce their own poultry. Demand grew, and specialized poultry farms developed. Few small farm flocks remained.

Small-scale and home production of chickens is currently on the rebound (Figure 1-15). There is growing consumer demand for cage-free eggs and free-range chickens, providing a renewed opportunity for small-scale producers. Many towns across the U.S. are changing their zoning laws to allow homeowners to keep a small number of laying hens, but roosters are sometimes banned.

The history of the turkey is less well-known. It is thought that turkeys were domesticated in the Americas and that they are descended from two species native to Mexico and the United States. Most of the American varieties were probably developed from the species found in the United States.



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FIGURE 1-15

Keeping chickens in the backyard is becoming popular again for fresh eggs, pleasure and insect control.

Classification of Animals

In science, it is necessary to have a logical system to classify living things in order to study and describe them. Living things are classified in the following categories, from the broadest to the most specific: Kingdom, Phylum (or division), Class, Order, Family, Genus, and Species.



Science Connection

Some students find it helpful to have a mnemonic, or memory aid to remember a group of items or classifications. It is much easier to remember “**K**ings **P**lay **C**hess **O**n **F**ine **G**reen **S**ilk” than to remember the order of Kingdom, Phylum, Class, Order, Family, Genus and Species.

All domestic animals are included in the Animalia or Animal Kingdom. There are five major kingdoms, with the two largest being Plantae (Plants) and Animalia (Animals). It should be noted that some authorities recognize more than five kingdoms. Domestic animals are further classified as Phylum Chordata, animals with a backbone, and Subphylum Vertebrata, having a backbone or skeleton. Animals may be further divided into classes. Class Mammalia (for mammals such as livestock, cats, and dogs), Aves (for birds such as chickens and turkeys), Reptilia (reptiles), Amphibia (amphibians) and several others.

Class Mammalia

Mammals share several distinguishing characteristics. They have four-chambered hearts and are warm-blooded, or **homeothermic**, meaning they can maintain their own body temperature. They have a diaphragm that separates the thoracic, or chest cavity from the abdominal cavity; this helps them breathe more efficiently. Their bodies are covered

homeothermic

warm-blooded; the ability to maintain one's own body temperature



Delmar/Cengage Learning

FIGURE 1-16

Mammals give birth to live young, and the mothers produce milk for their young.

species

a group of animals with many common traits

with hair. The embryo develops in the mother's uterus and the young are born live. (Figure 1-16). The mother secretes milk for the young through the mammary glands.

Class Aves

Birds fall into the class Aves. Birds also have four-chambered hearts and are homeothermic, with a body temperature slightly warmer than that of mammals. Their bodies are covered with feathers. They have light, hollow bones and an air-sac system attached to the lungs. They lay eggs in which their young develop. Aves have beaks and gizzards instead of teeth. Chickens, ducks, and turkeys all belong to this class.

Order, Genus, Species

Each class can be broken down by order. Each class has at least one order, with most having multiple orders. Class Mammalia can be broken down into rodentia (rats, mice, squirrels), primates (monkeys), carnivore (dogs, cats) and many more. Orders are broken down into Families. The order Carnivora can be broken down into Canidae (dogs), Felidae (cats), and others.

The next distinction is the genus. The family Felidae, for example, can be divided into *Acinonyx* (cheetah), *Panthera* (lion, tiger), *Felis* (domestic cat) and others.

The last major classification level is the **species**. Species may also be subdivided into varieties, breeds, or strains for further grouping. The scientific name of an animal includes its genus and species name. The genus *Panthera* can be divided to include *Panthera leo* (lion) and *Panthera tigris* (tiger). Note that the genus is placed in front of the species. The genus name is capitalized; the species name is not. In written material, the genus and species names are italicized. Another example is the scientific name of the horse which is *Equus ferus*. Table 1-2 lists the classifications for common livestock.

TABLE 1-2

Classification of Common Farm Animals

Common Name	Phylum	Subphylum	Class	Order	Family	Genus	Species
Alpaca	Chordata	Vertebrata	Mammalia	Artiodactyla	Camelidae	<i>Llama</i>	<i>pacos</i>
Bison	Chordata	Vertebrata	Mammalia	Artiodactyla	Bovidae	<i>Bison</i>	<i>bison</i>
Cattle	Chordata	Vertebrata	Mammalia	Artiodactyla	Bovidae	<i>Bos</i>	<i>taurus</i> (most of the domestic breeds)
Cattle	Chordata	Vertebrata	Mammalia	Artiodactyla	Bovidae	<i>Bos</i>	<i>indicus</i> (humped cattle)
Chicken	Chordata	Vertebrata	Aves	Galliformes	Phasianidae	<i>Gallus</i>	<i>domesticus</i>
Donkey	Chordata	Vertebrata	Mammalia	Perissodactyla	Equidae	<i>Equus</i>	<i>asinus</i>
Duck	Chordata	Vertebrata	Aves	Anseriformes	Anatidae	<i>Anas</i>	<i>platyrhyncha</i>
Emu	Chordata	Vertebrata	Aves	Casuariiformes	Dromiceidae	<i>Dromiceius</i>	<i>novaeahollandiae</i>
Goat	Chordata	Vertebrata	Mammalia	Artiodactyla	Bovidae	<i>Capra</i>	<i>hircus</i>
Goose	Chordata	Vertebrata	Aves	Anseriformes	Anatidae	<i>Anser</i>	<i>anser</i>
Horse	Chordata	Vertebrata	Mammalia	Perissodactyla	Equidae	<i>Equus</i>	<i>caballus</i>
Llama	Chordata	Vertebrata	Mammalia	Artiodactyla	Camelidae	<i>Llama</i>	<i>glama</i>
Ostrich	Chordata	Vertebrata	Aves	Struthioniformes	Struthionidae	<i>Struthia</i>	<i>camelus</i>
Rabbit	Chordata	Vertebrata	Mammalia	Lagomorpha	Leporidae	<i>Oryctolagus</i>	<i>cuniculus</i>
Rhea	Chordata	Vertebrata	Aves	Rheiformes	Rheidae	<i>Rhea</i>	<i>americana</i>
Sheep	Chordata	Vertebrata	Mammalia	Artiodactyla	Bovidae	<i>Ovis</i>	<i>aries</i>
Swine	Chordata	Vertebrata	Mammalia	Artiodactyla	Suidae	<i>Sus</i>	<i>scrofa</i> (evolved from wild hog of Europe)
Swine	Chordata	Vertebrata	Mammalia	Artiodactyla	Suidae	<i>Sus</i>	<i>vittatus</i> (evolved from wild hog of East India)
Turkey	Chordata	Vertebrata	Aves	Galliformes	Meleagrididae	<i>Meleagris</i>	<i>gallopavo</i>

Uses of Animals

Animals are a part of our everyday lives as well as a main food source (Figure 1-17). In addition to food, animals are a source of clothing, power, companionship, guardianship, recreation, and numerous other uses.



Courtesy of USDA, Keith Weller

FIGURE 1-17

Animal products are a major source of protein in human diets.

non-ruminant

an animal that has a simple one compartment stomach

ruminant

an animal that has a stomach divided into several compartments

rumen

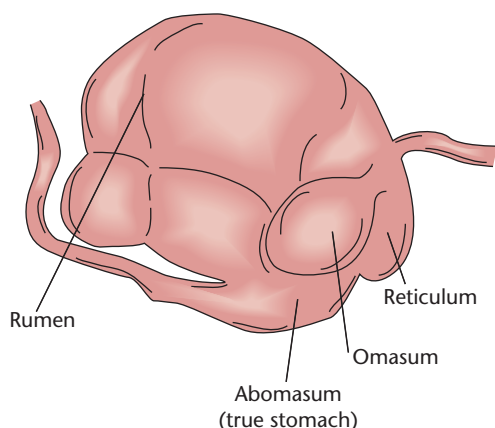
the largest compartment in the ruminant stomach

Converting Feed into Food

The major use of animals, of course, is for food. Animals convert feed grains and roughages into increased body mass, which is then used as food for human consumption. **Non-ruminant** animals such as swine and poultry are only fed grains, not roughages. Like humans, they cannot digest roughages such as grass and hay.

Ruminants are animals that have a stomach which is divided into several compartments. These animals regurgitate and chew their feed after they swallow it. True ruminants have a 4-compartment stomach (Figure 1-18). True ruminants include cattle, bison, sheep, and goats. The largest of the compartments in true ruminants, the **rumen**, contains microorganisms that allow ruminants to digest many kinds of feed that nonruminant animals cannot digest.

Ruminants are important because they have the ability to convert large quantities of roughage material into human food. Almost half of the energy in the major cereal crops such as corn, wheat, and

**FIGURE 1-18**

The four divisions of the ruminant stomach.

rice is found in parts of the plant, such as the stems, which are not used by humans for food. Ruminants can break down the fibers in these tough plant parts, and metabolize these crop residues into meat and milk for human consumption.

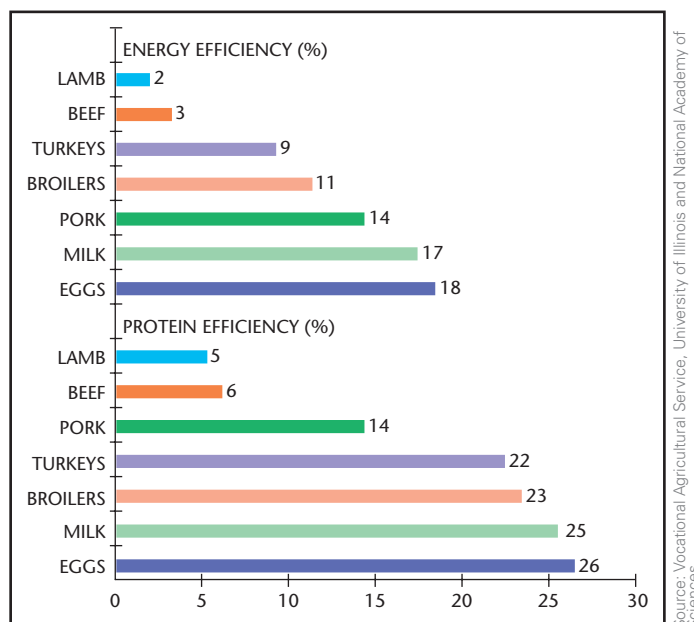
A large percentage of the human population obtains its protein, fats (lipids), iron, niacin, and some vitamins (including vitamin B₁₂) from the meat produced by ruminant animals. Because of variations in land and climate, many people of the world have no other source of these nutrients other than food products from ruminants. Ruminants provide about 45 percent of the protein, 32 percent of the fat, 50 percent of the phosphorus, and 77 percent of the calcium found in the diets of people living in the United States. About one-third of the total amount of food eaten by people in the United States comes from ruminants. The efficiency of the major farm animals in converting feed into protein and energy for human use is shown in Figure 1-19.

Clothing

Some livestock animals are important in providing fiber and skin for the production of clothing and leather products. Leather is produced from the hides

FIGURE 1-19

A comparison of the efficiency of major farm livestock in converting feed calorie intake to food calorie output (energy efficiency), and converting crude protein in feed into edible protein in the form of meat, milk, and eggs (protein efficiency).



Source: Vocational Agricultural Service, University of Illinois and National Academy of Sciences

FIGURE 1-20

Animals also provide fiber for use in the creation of clothing.



Delmar/Cengage Learning

of animals. Leather can be expensive and is a valuable material in the clothing industry. Leather is durable, allows air to pass through it, and is warmer than most other types of clothing. Natural fiber and fur from production animals are used in making coats, gloves, and other clothing (Figure 1-20). Wool fiber is warmer than most other fibers, both synthetic and natural. Wool fibers interlock with each other, helping to trap air close to the body while wicking away moisture.

Power

At one time, animals provided most of the power used by humans (Figure 1-21). With advancements in mechanical technology, and the development of alternative methods of power production, the use of animals for power has declined. Most animal power in the United States today is for novelty, such as pulling wagons. Draft animals are sometimes used on historical farms for educational purposes. Religious sects, such as the Amish, often use animal power rather than machines as part of their culture. In some parts of the world, especially in economically disadvantaged countries, animals are still a major source of power.



Courtesy of Aaron and Jason Deschu

FIGURE 1-21

Animals once provided most of the power used in agriculture.

**FIGURE 1-22**

Horseback riding is a very popular sport in the United States.

Recreation and Companionship

Animals are used as a source of recreation and companionship. Horseback riding is a popular recreation activity (Figure 1-22). Other activities with animals include racing, animal shows, and exhibitions. Companion animals, such as cats and dogs, are highly valued in the U.S.; over 60% of homes have at least one pet.

Other Uses

Livestock produce large amounts of manure. Disposal of the manure can be a problem. Many producers use manure as a fertilizer. Animal manure can also be used as a fuel source. In many parts of the world, animal manure is dried and used for cooking fuel, as well as to heat homes.

High oil prices have many scientists exploring the use of methane gas converters. Animal manure can be used as a raw material in such a converter. If the manure made by about 40 cows could be properly converted, it could provide enough heat and electricity for an average farm in the U.S. Some large farms and feedlots in the United States have built bio-gas plants to utilize the animal manure produced (Figure 1-23).

Some dairies are starting to use anaerobic (without oxygen) manure pits that convert methane gas accumulations into electricity. Government agencies are giving financial aid to those farmers interested in pursuing this technology.

By-products

Animal by-products make valuable contributions to society. By-products of animals include fat, bones, intestines, hides, and blood. Some by-products are considered culinary delicacies by many people. These by-products may also be used in the production of other products such as pet food. Some types of feed ingredients for livestock are derived from animal



Courtesy of USDA, Keith Weller

FIGURE 1-23

Modern science is finding new uses for animal products everyday.



© iStockphoto/Gord Home

FIGURE 1-24

Fats, lipids, and oils from animals are used in the manufacture of cosmetics.

by-products. These include blood meal and meat and bone scraps.

Edible by-products include gelatin produced from hooves, horns, bones, and hides. Gelatin is used in the production of gelatin desserts, marshmallows, canned meats, and ice cream.

Fat from animals is used in the production of cosmetics, waxes, soap, lubricants, and printing ink (Figure 1-24). Bones, horns, and hooves are also used in the production of glue, buttons, bone china, camera film, sandpaper, dice, piano keys, wallpaper, and toothbrushes. Hair from animal hides is used in making brushes, rug padding, house insulation, and upholstering materials for furniture. Artists' paintbrushes are made from the fine hair found in the ears of animals.

More than 100 drugs used by humans are made from animal by-products. Historically, insulin has been extracted from the pancreas of animals to treat human diabetes. Animal by-products are an important resource in the production of some of the most commonly used items in today's society. By-products are also used in the manufacture of perfumes, fertilizers, candles, lanolin, and glycerin, as well as many other products.

Medical Research

Animals have been used in medical research for a long time. Many medications and surgical procedures that we use have come from studies done on animals. This is a subject that is highly controversial on both sides of the debate. However, there is no doubt that medical research using animals has prolonged and improved the lives of humans.

Trends in Animal Agriculture

Animal agriculture is a complex industry that is constantly changing. Keeping up with changes in the diverse segments of animal agriculture is a daunting task. Students of agriculture should be familiar with the general trends of the industry. Many of the trends refer to a specific species, while others overlap several species.

Production and Consumption

The most significant factors that drive animal production in the Western hemisphere are the preferences and eating habits of those in the Americas. To remain profitable, producers must supply the food that the consumer desires.

Meat consumption in the U.S. is at a record high. Overall, per capita meat consumption will increase

or remain steady into the near future. America has been, and is, a nation of meat eaters. In 2000, total meat consumption (red meat, poultry, and fish) reached 195 pounds per person. In the 1950s, that number was about 138 pounds per person. In addition, the meat industry has provided scores of new, brand-name, value-added products that have been processed for consumers' convenience. Nutritional concern about fat and cholesterol has prompted the production of leaner animals.

Eating habits related to health concerns of Americans have driven and continue to drive production. Concern over cholesterol levels caused a decrease in consumption of red eggs for a number of years. Consumption has stayed relatively steady in recent years, and that trend is expected to continue into the near future. Consumers are demanding leaner meat and less fat in meat and dairy products. Poultry consumption continues to increase because many consumers consider it healthier than red meat.

Nutrition labels are required for any food that is not in its original form. Raw meats, fruits and vegetables do not need a nutrition label if they are fresh. A nutrition label tells the consumer how many calories per serving are in the product and which ingredients are present. The fat, cholesterol, sodium, carbohydrates, and protein are listed (in grams/milligrams), as well as a listing of the vitamins present (Figure 1-25).

The increased efficiency of mechanization over recent years has resulted in the increased production of livestock. It is anticipated that increased efficiency will result in larger operations that can afford more automation.

The number and size of farms in the United States will continue to change. Farms will become larger and many smaller operations will go out of business, resulting in fewer total farms. The efficiencies of large-scale production units will allow large companies and larger farming units to thrive. For example, in the swine industry, 10 percent of the farms produce over 75 percent of the pigs.

Nutrition Facts

Serving Size: 1/2 Cup
Servings Per Container: 4

Amount Per Serving	
Calories 100	Calories from Fat 30
% Daily Value*	
Total Fat 3g	5%
Saturated Fat 0g	0%
Cholesterol 0mg	0%
Sodium 340mg	14%
Total Carbohydrate 15g	5%
Dietary Fiber 1g	4%
Sugars 0g	
Protein 2g	
Vitamin A 0%	Vitamin C 0%
Calcium 0%	Iron 2%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:

Fat 9 ∞ Carbohydrate 4 ∞ Protein 4

Ingredients: Flour, Water, Yeast
Vegetable Oil, Salt, Artificial
Flavor and Color.

FIGURE 1-25

All processed food must have a nutrition label attached.

Courtesy of FDA

Pets

Spending on pets will continue to increase, including pet insurance, medications, toys, clothing, health care, and pet foods. High-end specialty pet stores continue to thrive. Pet owners are including their pets in their own lifestyles. Visits to the spa with prescribed pet exercise regimens and hotel-quality accommodations for overnight pet care are becoming more commonplace in urban areas. Commercial pet cemeteries have become common. Many pet owners are including their pets in their wills to assure continued care of their pets after their deaths.

Individual identification of animals is becoming common and may eventually be required. Identification of pets as well as other animals includes implanted microchips that are becoming more commonly used in pets as well as livestock. Lost pets are more easily reconnected with their owners if they are implanted with microchips.

Hybrid pets will increase in popularity. Hybridized dogs have been in demand in recent years. They are gaining a lot of attention from pet owners looking for something that might be the best of two breeds or exhibit hybrid vigor. In the year 2007, hybrids entered the mainstream – Puggles, Maltipoos, and Golden Doodles are some examples. The big advantage of the recently introduced poodle crosses is that they are hypoallergenic. People who have allergies can now enjoy the company of pets.

hybrid pet

Cross breeding of two common animal breeds to create a new breed

Animal Welfare and Animal Rights

There is a significant difference between people who are concerned about “animal welfare” and those who believe in “animal rights.” There are many groups within each of these divisions, with many differing opinions about animals.

animal welfare

emphasizes the humane treatment of animals in both research and production

Animal Welfare

Animal welfare supporters emphasize the humane treatment of animals, both in research and production agriculture. They believe that animals can be used to benefit humans. People who support animal welfare believe that the use of animals for food and medical research is essential. Most animal producers fall into the animal welfare category. Producers know that well-cared for, healthy, non-stressed animals perform best. It is in their best interest to assure the welfare of their animals.

Animal Rights

The views of animal rights activists vary, but most advocate the total elimination of all animal use by humans (Figure 1-26). Many animal rights activists think that animals should have the same rights as humans. Some animal rights groups take a moderate approach and try to achieve their goals by influencing legislation, while other animal rights groups use violent and illegal tactics.

Those who produce animals should do the best possible job of providing humane treatment to their animals. Animals which are treated well and not stressed are more efficient producers. Anyone who cares for animals needs to be concerned about the



FIGURE 1-26

Animal activist groups range from law abiding to militant.

image they portray, including students showing livestock. Concern and welfare for the animal should be a priority.

Government Regulation

There are many governmental agencies that regulate agricultural production. These agencies may be at the federal, state, or local level. The most all-inclusive agencies are those at the federal level.

United States Department of Agriculture (USDA)

The USDA was founded in 1889 to aid agriculture through education and research. Today, the USDA develops and executes policies for farming, agriculture, and food production. This department aims to meet the financial needs of farmers or ranchers, promote agricultural trade, assure food safety, protect natural resources, and foster rural communities. The USDA is in charge of maintaining the health of laboratory animals, and is also responsible for federal inspection of animal product processing plants, from meats to by-product production.

Agricultural Research Service (ARS) A branch within the USDA, the Agricultural Research Service (ARS), conducts research to develop solutions to agricultural problems. The agency strives to ensure high-quality, safe foods, enhance the natural resource base, and provide economic opportunities to rural citizens and communities. The ARS is best known for compiling and maintaining the information in the National Agricultural Library.

Animal and Plant Health Inspection Service (APHIS) The Animal and Plant Health Inspection Service (APHIS) is a subunit of the USDA. The mission of APHIS is to protect the health and

value of American agriculture and natural resources by offering protection from invasive non-native plants, predatory wild animals, and disease, preventing inhumane animal treatments, and monitoring existing agricultural pests and diseases.

Food Safety and Inspection Service (FSIS) The Food Safety and Inspection Service (FSIS) is a branch of the USDA and is responsible for ensuring that all meat, poultry, dairy, and processed egg products in the United States are safe to consume and are appropriately labeled. The agency is also responsible for the inspection of processing plants and for enforcing food handling procedures.

Food and Drug Administration (FDA)

The Food and Drug Administration (FDA) is an agency of the United States Department of Health. It is responsible for safety regulations that apply to foods, drugs, vaccines, medical and veterinary equipment, and the processes of disease control. This agency protects both human and animal health through intense testing programs.

United States Environmental Protection Agency (EPA)

The EPA is a federally supported agency responsible for protecting human health and safeguarding the natural environment. The EPA affects agriculture and farming through its policies and regulations on pesticide control, waste management, and land management. Regulations of the EPA currently have a major impact on animal agriculture. Increasing regulations to protect the environment and human health often result in an increase in the cost of production and time needed to study and meet EPA requirements.

Summary

The domestication of animals played an important role in the development of civilization. Early explorers brought livestock, poultry, and other animals to the Americas. Animals spread across the United States with the colonists as they moved westward. Today, most animal production occurs near a plentiful feed source, such as swine production in the Corn Belt.

Animals are classified by physical characteristics and function. Mammals are warm-blooded, covered with hair, and develop in their mother's uterus. Birds (Aves) are also warm-blooded, but are covered with feathers and develop in eggs outside of the mother's body. Animals that have been classified by use are: livestock, poultry, exotic, companion, and captive animals. Ruminants are livestock animals that can convert large amounts of roughage into food for human consumption.

Animals have many useful functions. They convert feed into food, are a source of materials for clothing, provide power and are a source of recreation and companionship. While animals are raised mostly for meat, milk, and fiber, many by-products of animals are also important to society.

Consumers, activists, and the government all affect animal industries. Production practices change based on the type of product that is desired by the consumer. Animal welfare supporters emphasize the humane treatment of animals, while animal rights activists advocate the elimination of all animal use by humans. Government agencies regulate animal production based on concern for health, safety, and the environment.

Quick Facts

- The study of animal science covers all domestic animals.
- Animals are used for work, food, medicine, recreation, and companionship.
- Up to 18% of U.S. jobs are directly related to agriculture.
- The animal industry includes products such as feed additives, biological compounds, and pharmaceuticals.
- The domestication of animals was an important event in human history that helped develop civilization.
- Animal breeds developed as humans selected animals with the most desirable characteristics.

- The swine industry is concentrated in the Corn Belt states, where feed is plentiful.
- Much of the poultry industry, especially broiler production, is concentrated in the southern part of the United States.
- Mammals are warm-blooded, covered with hair, and develop in their mother's uterus.
- Birds (Aves) are warm-blooded, covered with feathers, and lay eggs in which their young develop.
- Ruminants are animals that can convert large quantities of roughage into body mass (meat) that is then used as food for human consumption.
- About one-third of the total amount of food eaten by people in the United States comes from ruminants.
- Livestock are produced primarily for meat, milk and fiber; poultry are produced primarily for meat and eggs. Other products are called by-products.
- Animal welfare supporters emphasize the humane treatment of animals, while animal rights activists advocate the elimination of all animal use by humans.
- The animal production industry is subject to the rules of government regulatory agencies (USDA, ARS, APHIS, FSIS, FDA and EPA).

Student Learning Activities

1. Survey the farms in a community, collecting data on the size of farm, and kind and size of livestock enterprises on the farms. Prepare a report showing the data summarized.
2. Prepare and present an oral report on one of the following topics:
 - a. the domestication of animals
 - b. the location of livestock enterprises in the U.S.
 - c. the use of animals
 - d. trends in animal agriculture
 - e. animal rights and welfare issues
 - f. food safety
3. Obtain the most current values of livestock sales for the categories in Figure 1-5. Prepare a table that includes the current data as well as the data from Figure 1-5.
4. When planning and conducting one's supervised agricultural experience program, take into consideration the most common animal enterprises found in the local area.

Discussion Questions

1. Why was the domestication of livestock important to the development of civilization?
2. From what two wild stocks of swine were the American breeds of swine developed?
3. What was the main use of the horses brought to the United States by the early colonists?
4. What changes have taken place in the poultry enterprise from colonial times to the present?
5. Name and briefly describe the uses of animals in our modern society.

Review Questions

True/False

1. Domestication means to adapt the behavior of an animal to fit the needs of people.
2. The wild mallard duck has no relationship to modern breeds of domesticated ducks.
3. Livestock producers generally support proper feeding, housing, and other good management practices because these activities lead to more efficient production.
4. Animal welfare and animal rights have the same philosophy about animal use.
5. Companion animals include zoo animals.

Multiple Choice

1. Adapting the behavior of animals to fit the needs of humans is called _____.
 - a. training
 - b. domestication
 - c. breeding
 - d. culling
2. The consumption of poultry is _____.
 - a. increasing
 - b. decreasing
 - c. remaining the same
 - d. difficult to determine

3. Which of the following is true about mammals?
 - a. They develop in eggs outside the mother's body.
 - b. They have an air sac system attached to their lungs.
 - c. They are warm-blooded.
 - d. They are covered with feathers.
4. The classification system for animals is:
 - a. Kingdom, Phylum, Order, Genus, Class, Species
 - b. Phylum, Kingdom, Species, Class, Order, Genus
 - c. Kingdom, Phylum, Class, Order, Family, Genus, Species
 - d. Species, Family, Phylum, Kingdom, Order, Genus, Class
5. Domestication of animals helped humans to _____.
 - a. adapt
 - b. survive
 - c. develop
 - d. all of the above

Completion

1. Modern cattle are descendants of the _____.
2. Chickens were being raised by the Chinese about _____.
3. Bos _____ includes the European breeds of cattle.
4. _____ and sheep were some of the first domesticated animals.
5. _____ research helps to develop new treatments for humans.

Short Answer

1. Why was domesticating and confining animals so important to the food supply of early civilizations?
2. List and discuss uses of animals.
3. What is the basic difference between the concerns of animal welfare and animal rights activists?
4. Name and describe the functions of the main government agencies that regulate animal production.
5. Explain the classification system of animals.



CHAPTER 2

Career Opportunities in Animal Science



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe career opportunities in animal science.
- Explain trends in animal science.
- Describe educational requirements for animal science careers.
- Describe the process of choosing an occupation.
- Compare production and off-farm career opportunities.



KEY TERMS

niche markets

vertical
coordination/
integration

career pathway

associate's degree
technical college
bachelor's degree

convenience food
entrepreneurship
skill

LANGUAGE CONNECTION

English	French	Spanish	German	Italian
Agriculture	Agriculture	La Agricultura	Landwirtschaft	Agricoltura
Career	Carrière	La Carrera	Karriere	Carriera
Business	Affaires	La Empresa	Betrieb	Affare
Education	Éducation	La Educación	Erziehung	Istruzione

Employment in Animal Science

The animal science industry is vitally important to the food supply, and for the care of companion animals. Although dramatic changes are taking place in the agriculture industry, there will continue to be career opportunities for people interested in animal science.

Animal science is a broad career pathway that provides many opportunities. Animal science includes the production, nutrition, care, and use of all animals, including beef cattle, dairy cattle, horses, poultry, sheep, goats, swine, rabbits, cats, dogs, bison, elk, deer, llamas, and alpacas. In addition, animal science includes the efficient processing and distribution of meat, poultry, and dairy products. Animal science includes the use of companion animals for recreation and leisure purposes, and the maintenance of animal health and well-being.

The future of the animal science industry is complex. The animal science industry needs professionals who can identify opportunities and devise innovative solutions for future production, as well as business, environmental, and social challenges (Figure 2-1). A broad knowledge of the animal sciences prepares students for a variety of rewarding careers.

Because the animal science industry is so broad and diverse, there are many career opportunities that require a variety of interests and skills. Previous experience with animals is helpful, but not essential.

FIGURE 2-1

Careers in animal agriculture include specialists who can advise producers.



Courtesy of NRCS

Degree programs, along with an interest in animal science and a desire to learn, will prepare a student for a successful career in the animal science industry.

Employment Trends in Animal Science

Changes in the animal science industry will affect employment opportunities. New jobs will be created; some jobs will be changed, while others will become obsolete. A student considering a career in agriculture should be aware of problems, trends, and challenges in the agriculture industry. The following list is a sample of current and future issues the industry is facing.

Food Demand and Pricing

- ◀ Demand for food will increase as the population increases.
- ◀ Demand for convenience foods and other processed products will increase.
- ◀ Health foods will become increasingly more popular and demand will increase.
- ◀ Increased interest in organically and locally produced foods will create **niche markets**.

niche market

narrowly defined groups of customers within a market

Consumer Concerns

- ▶ Animal welfare and animal rights groups will continue to influence agricultural production.
- ▶ Consumers will exercise more influence in agriculture, especially in the choice of methods used in animal production.
- ▶ Consumer concerns about controversial agricultural practices, such as genetically modifying plants and animals, will continue to increase; in addition, it is highly likely that more government regulations to control these processes will be enacted.
- ▶ Food safety issues will become increasingly more important.
- ▶ Growing environmental concerns will impact how and where animals are produced.



Courtesy of USDA, Keith Weller

FIGURE 2-2

Livestock manure is a source of alternative fuel.

Technology and Biotechnology

- ▶ Production of alternative energy resources from agricultural products, such as ethanol, will increase (Figure 2-2).
- ▶ Animal production will become increasingly more efficient through biotechnology.
- ▶ Animal production will become increasingly more automated, requiring less manual labor.

Productivity

- ▶ Production will become more specialized.
- ▶ More productive animals and automation will increase yields and lower costs to the consumer.
- ▶ Productivity and efficiency will continue to increase.

Farms and Land Use

- ▶ Individual farms will continue to become larger in acreage (Figure 2-3).

FIGURE 2-3

Although the total number of farms in the United States is decreasing, the average farm size continues to increase.



Courtesy of USDA

- ▶ The total number of full-time farms will continue to decrease.
- ▶ Part-time farms may increase in response to the organic and locally grown food movement.
- ▶ Total land devoted to farms will decrease. Less land will be in production.
- ▶ Family farms will decrease and corporate farming will increase.
- ▶ Land prices will rise in response to encroachment of cities and towns into the countryside.
- ▶ Non-farm control of land and land use will increase through zoning and land use ordinances.

Employment

- ▶ More farmers and ranchers will be needed in the near future to replace an aging agriculture workforce.
- ▶ The number of people in production agriculture will remain stable or decrease slightly.
- ▶ The number of people working in agriculture-related jobs will remain stable or increase slightly.

vertical coordination/integration

when one firm owns two or more steps of the production process, including production of inputs and distribution



Image Source/Image Source/Getty Images

FIGURE 2-4

The companion animal industry generates billions of dollars each year.

career pathway

a broad group of careers that share similar characteristics and educational requirements

- ◀ The shortage of food animal veterinarians will continue, and the number of companion animal veterinarians will increase.
- ◀ The shortage of highly trained professionals in agriculture will continue.

Agribusiness

- ◀ Almost all food animals will be produced under contract with large companies.
- ◀ **Vertical coordination/integration** of production components will increase.
- ◀ Competition will increase as world trade increases in a global economy.

Companion Animals

- ◀ The number of companion animals will increase (Figure 2-4).
- ◀ Companion animals will continue to be popular, creating increased career opportunities.

Education in Animal Science

Education for a career in animal science should be more than a degree program and career preparation (Figure 2-5). An education should provide the individual with a broad and flexible base of knowledge that can be adapted to the constantly evolving professional environment. Most importantly, an education should establish a foundation for a career the individual will enjoy.

There are many different educational requirements for careers in animal science. Students should choose a **career pathway** in which they are interested. Animal Science, Plant Science, and Agriculture Mechanics are examples of career pathways. A student interested in the animal science pathway can get a basic foundation of knowledge in animal

FIGURE 2-5

A good education is key to a successful career.



Courtesy of Shannon R. Lawrence

science in middle school and high school. The student can then specialize in a more specific area of animal science in college.

Careers that do not require a college degree include rancher, farm worker, companion animal breeder, companion animal trainer, animal caretaker (such as in animal shelters or pet stores), animal control worker, and veterinary assistant. Although no formal degree is required, most employers require employees to complete on-the-job training programs.

Individuals interested in more advanced careers in animal science must attend college. Degrees in animal science are available at two-year or four-year colleges. A two-year college offers **associate's degrees** and certificate programs. Examples of associate degrees include those in Meat Technology, Veterinary Technology, Farrier Technology, and Food Science and Technology. **Technical colleges** are specialized two-year colleges that offer programs that focus on technical and career training and education. Individuals who receive certification in a technical program are eligible to immediately enter the workforce.

A four-year college, or university, offers **bachelor's degrees** to students who complete a four-year program of study. Examples of four-year college

associate's degree

a two-year degree that provides training and specialization (e.g., Associate of Applied Science (A.A.S. or A.S.))

technical college

a two year college that offers programs focused on career training and education

bachelor's degree

a four year degree in a particular field of study

FIGURE 2-6

Veterinarians can specialize in small animal care, large animal care, or exotic animal care.



degrees include Animal Science, Agribusiness, and Agricultural Economics. Most careers in animal science require a bachelor's degree. Many students who successfully complete the requirements for a bachelor's degree pursue graduate and postgraduate degrees. Animal science is a broad career pathway that provides many opportunities. Students who complete the requirements for Master's and Doctoral degrees typically receive higher salaries and are eligible for higher-demand careers. For example, veterinarians must receive a DVM (Doctor of Veterinary Medicine) degree before they are eligible for employment (Figure 2-6).

Employment Opportunities in Animal Science

Agribusinesses are concerned about a shortage of college graduates with training in the field of agriculture. Current estimates say that there will be a continuing shortage of university graduates with training in agriculture. There will be more jobs available and fewer qualified workers to fill these positions.

Most careers in agriculture are not in the production sector but are in related fields such as sales and service, education, biotechnology, and

FIGURE 2-7

Career opportunities in food processing are increasing.



Courtesy of USDA, Keith Weller

agribusiness (Figure 2-7). Most of these careers require a minimum of two years of post-high school education, and many are in the field of animal science. Approximately 18% of all jobs in the United States are related to agriculture.

New technologies are providing more job opportunities in the fields of agribusiness, communications, science, and sales. The right combination of skills, education, training, and experience can lead to exciting careers in the agriculture industry.

Animal Production

Farms are becoming increasingly larger in the United States, but the total number of farms is declining. Twenty-eight percent of the farms in the United States produce 87 percent of all farm products. While larger and more productive farms have caused a decrease in total farm labor needs, two trends help keep the demand relatively high for workers in production agriculture. The first trend is the demand for locally grown and organic agricultural products. This trend is creating smaller, specialized niche markets that provide job opportunities for small-scale farms. The second trend is the aging of farmers in this country. The average age of a farmer in the U.S. is 54.3 years old, reflecting a growing need for younger individuals interested in agriculture, including animal production.

**FIGURE 2-8**

Managers of cattle operations must have a good background in animal science.

Some typical occupations related to animal science that are found in this category include:

- ◀ Cow/Calf Producer
- ◀ Farm Manager
- ◀ Farmer
- ◀ Feedlot Manager
- ◀ Organic Farmer
- ◀ Rancher (Figure 2-8)

Animal Training and Care

Careers in the area of animal training and care focus on the maintenance and care of companion and zoo animals. Animal caretakers work in a variety of settings, such as kennels, veterinary clinics, zoos, and animal shelters, ensuring the safety and well-being of the animals. Employment in animal training and care is expected to increase in the future.

Some typical occupations related to animal science that are found in this category include:

- ◀ Dog Trainer
- ◀ Horse Trainer
- ◀ Pet Groomer
- ◀ Pet Shop Manager
- ◀ Zoo Manager
- ◀ Zoologist

Science and Veterinary Medicine

Veterinarians care for the health of animals, including livestock, companion animals, wildlife, and zoo animals. Veterinarians can choose to work with large animals, small animals, or both. There is a growing shortage of veterinarians in the food animal area (swine, beef cattle, dairy, poultry, etc.) as compared to veterinarians specializing in the care of companion animals. Many veterinarians establish their own business while others work for organizations like

FIGURE 2-9

Most veterinarians that specialize in small animals concentrate their practice on dogs and cats.



Courtesy of Julianne Monko

pharmaceutical companies. They can also work for different branches of the federal and state governments as inspectors, researchers, law enforcers, or disease-control workers.

Opportunities for careers in veterinary medicine are expected to increase 35 percent by 2016 (Figure 2-9). Veterinarians must earn a Doctor of Veterinary Medicine degree and obtain a state license before they are allowed to practice medicine. It takes about seven to eight years of college study after high school to become a veterinarian. Admission into veterinary school is challenging and competitive.

Scientists, Engineers, and Related Specialists

These professions generally require at least a bachelor's degree, and many require a master's or doctoral degree. People who have obtained this type of training generally work in a specialized area of animal agriculture.

Agricultural engineers apply their knowledge of technology and science to the efficient use of agricultural resources. Agricultural engineers may develop ways to improve product storage, increase production efficiency, or improve agricultural buildings and

equipment. Environmental engineers employ their knowledge of biology and chemistry to find solutions for conserving and protecting the environment. Environmental engineers work with issues such as disposing of animal wastes, pollution control, and soil and water conservation.

Biochemists, entomologists, geneticists, and microbiologists are biology-intensive occupations related to animal science. Biochemists study living cells to advance the understanding of growth, metabolism, and reproduction. Entomologists study insects to better understand the control of insects that infest animals as well as crops. Geneticists study genes to understand heredity and variation of different organisms. The use of the science of genetics is the most important factor in the breeding efforts to improve animals. Microbiologists study microorganisms, such as bacteria, fungi, and algae.

Some typical occupations related to animal science in this category include:

- ▶ Agricultural Engineer (Figure 2-10)
- ▶ Biochemist
- ▶ Entomologist
- ▶ Geneticist
- ▶ Meat Scientist
- ▶ Microbiologist



FIGURE 2-10

Many career paths are related to agriculture.

Managers and Financial Specialists

Managerial positions in the field of animal science require knowledge of how to relate to and communicate with people, as well as knowledge of animal science. Many jobs in this category require at least a bachelor's degree, and many require a master's, or a doctorate degree.

Some typical occupations in this category that relate to animal science include:

- ◀ Business Manager
- ◀ Credit Analyst
- ◀ Economist
- ◀ Food Service Manager
- ◀ Retail Manager
- ◀ Wholesale Manager

Marketing, Merchandising, and Sales Representatives

About one-third of the employment opportunities for college graduates in agricultural careers are in marketing, merchandising, and sales. Graduates who wish to pursue a career in this field need good communication skills and a thorough knowledge of computer technologies used in business. These jobs are highly competitive because graduates from business schools also apply for these positions.

Some typical occupations related to animal science that are found in this category include:

- ◀ Exporter
- ◀ Food Broker
- ◀ Grain Merchandiser
- ◀ Livestock Buyer (Figure 2-11)
- ◀ Marketing Manager
- ◀ Purchasing Agent

FIGURE 2-11

Livestock buyers must be knowledgeable about the animals they purchase.



Courtesy of Cathy Collett, Livestock Marketing Association

convenience food

commercially prepared foods that can be consumed with little to no preparation by the consumer; also known as processed foods

Food Processing, Inspection, and Services

Career opportunities for individuals with degrees in the food products and processing field continue to increase as consumers demand more **convenience foods**.

Some typical occupations related to animal science that are found in this category include:

- ▶ Dietitian
- ▶ Food Inspector
- ▶ Food Products Developer
- ▶ Food Scientist
- ▶ Meat Processor
- ▶ Nutrition Counselor

Education, Communication, and Information Specialists

Overall, graduates looking for jobs in this area will readily find employment opportunities because there will be more jobs available than graduates willing to fill the positions. These jobs require a general knowledge of food production, agriculture, veterinary medicine, etc. Oral and written communication skills are especially important in this career area. The jobs in this area usually require at least a bachelor's degree.

FIGURE 2-12

Agricultural education teachers are a great source of information.



Courtesy of Shannon R. Lawrence

Some typical occupations related to animal science that are found in this category include:

- ◀ Agricultural Writer
- ◀ Agriculture Education Teacher (Figure 2-12)
- ◀ Cooperative Extension Agent
- ◀ Food Writer
- ◀ Public Relations Specialist
- ◀ Reporter

Entrepreneurship

entrepreneurship

the practice of starting a new business or organization in response to a recognized need or opportunity

An important component of the animal science industry, and any agricultural industry, is **entrepreneurship**. An entrepreneur can start a business in almost any animal science enterprise. There are usually no specific educational requirements to be an entrepreneur. However, in some cases, licenses to perform a specific skill (such as shoeing horses) may be required. Previous experience in the enterprise is always helpful in order to run a successful business. Businesses may range in scale from small ventures in which the owner is the only worker, to large businesses that employ many other people. Entrepreneurship through the Supervised Agricultural Experience (SAE) program is an important component of agricultural education and is emphasized in 4-H programs as well.

Choosing an Occupation

Selecting an occupation involves three basic steps. The first step is to evaluate individual academic abilities, skills, characteristics, and career goals. The second step is to obtain as much information as possible about potential careers and occupations. The third step is to take into consideration individual abilities and interests along with career requirements to determine the most desirable career path.

Self-Analysis

When choosing an occupation, it is important to keep in mind natural abilities. Grades in school and interest/aptitude testing administered by guidance counselors can help to determine a person's skills and abilities. Occupations are often chosen based on a specific talent or **skill**. Being able to handle animals is an important skill for anyone considering a job in animal science (Figure 2-13).

People perform best when their job interests them. Interests sometimes change as a person grows older. Individuals must decide whether or not an interest they have will be lasting or temporary. Selecting an occupation in an area of interest can lead to a rewarding career.

skill

the ability to do something particularly well, often achieved through practice, training, and experience



Delmar/Cengage Learning

FIGURE 2-13

Before pursuing a career with animals, the student needs to make sure he or she enjoys working with animals.

Studying an Occupation

When studying an occupation, it helps to have an outline of key points to follow. Individuals should consider each item on the list below when seeking information about a job or career. Students should rank the requirements in order of importance to them. Characteristics of a career include:

- ◀ educational requirements
- ◀ special skills required
- ◀ working hours
- ◀ salary

- ◀ geographical location
- ◀ indoor vs. outdoor work
- ◀ physical activity required
- ◀ travel requirements
- ◀ tools or machines used
- ◀ possible physical hazards
- ◀ amount of interaction with other people required
- ◀ variety of tasks involved

Making a Decision

After self-evaluating individual skills and characteristics and studying different occupations, a career pathway or specific career can be selected. Many high school students complete studies in a career pathway and then select a specific occupation during college.

Another way to further investigate a chosen occupation is to volunteer or work part-time in that area. Internships, both paid and unpaid, are becoming popular ways of exploring careers, as well as making contacts for future employment.

The best career is one that combines individual skills, interests, and abilities with the most desirable employment conditions. Many career pathways have numerous options that offer flexibility for career changes in the future. No matter what career an individual chooses, there will always be jobs available in the animal science industry.

Summary

As the animal science industry continues to evolve and expand, a growing number of jobs and career opportunities will become available. There are several predominant trends in agriculture that influence the animal science industry. These trends include food demand and pricing, consumer concerns, technology and biotechnology, productivity, farms and land use, employment, agribusiness, and companion animals. By understanding

these trends and their movements, individuals interested in careers in animal science will be better able to select a career with good employment opportunities as well as a career that interests them.

Careers in the animal science industry require a variety of skills and education degrees or certificates, depending on the career. Some careers require only a high school education, while others demand an associate's, bachelor's, master's, or even a doctoral degree. Individuals who are interested in the animal science industry should research their desired career choice and compare it to their personal interests, skills, and abilities.

Most careers in agriculture are not in the production sector but in related fields such as sales and service, biotechnology, and agriscience. A wide variety of careers are available in the animal science industry. These careers can be divided into nine categories: Animal Production; Animal Training and Care; Science and Veterinary Medicine; Scientists, Engineers, and Related Specialists; Managers and Financial Specialists; Marketing, Merchandising, and Sales Representatives; Food Processing, Inspection, and Services; Education, Communication, and Information Specialists; and Entrepreneurship.

While choosing a career can be difficult, the process can be divided into three basic steps. The first step, self-analysis, involves careful inspection of one's skills, talents, and interests. The second step, studying an occupation, involves in-depth research of a specific career, including working conditions and personality requirements. The third step, making a decision, involves combining the results of the first two steps to determine the most appropriate and enjoyable career choice for the individual.

Quick Facts

- Animal science is a broad career pathway that provides many career opportunities.
- The animal science industry needs professionals who can identify opportunities and devise innovative solutions to future production, business, environmental, and social challenges.
- A person considering a career in agriculture should be aware of problems, trends, and challenges in the agriculture industry.
- An education should provide the individual with a broad and flexible knowledge base that can be adapted to the constantly evolving career environment.

- Educational requirements for careers in animal science vary from a high school diploma to a doctoral degree.
- A two-year college, also called a community college, offers associate's degrees and certificate programs.
- Technical colleges are specialized two-year colleges that offer programs focusing on career and technical education.
- A four-year college, or university, offers bachelor's degrees to students who complete a four-year program of study.
- Agribusinesses are concerned about a shortage of college graduates with training in the field of agriculture.
- Most careers in agriculture are not in the production sector, but in related fields such as sales and service, biotechnology, and agriscience.
- There are nine career subdivisions in the animal science industry: Animal Production; Animal Training and Care; Science and Veterinary Medicine; Scientists, Engineers, and Related Specialists; Managers and Financial Specialists; Marketing, Merchandising, and Sales Representatives; Food Processing, Inspection Services; Education, Communication, and Information Specialists; and Entrepreneurship.
- Selecting an occupation involves three basic steps: self-analysis, studying an occupation, and making a decision.
- A skill is the ability to do something particularly well, often achieved through practice, training, and experience.
- The best career is one that combines individual skills, abilities, interests, and qualities with the most desirable working conditions.

Student Learning Activities

1. Prepare a bulletin board display of occupations in animal science.
2. Survey the local community to determine employment opportunities in animal science.
3. Invite people in animal science occupations to speak to the class.
4. Plan and conduct a Supervised Agricultural Experience program (SAE) in animal science.
5. Have students research a particular area of interest in animal science.

Discussion Questions

1. Discuss the change in farm size, number of farms and age of farmers in recent years.
2. What are some ways in which a young person can learn more about a career in animal science?
3. Explain why understanding trends in animal science is important to selecting a career.
4. Discuss the three basic steps in choosing an occupation.
5. What types of information should be known about an occupation in order to make a wise career decision?

Review Questions

True/False

1. A population increase in the United States and the world has caused increased demand for food.
2. Selecting an occupation involves three basic steps: self-analysis, obtaining information about the occupation, and making a decision.
3. Family farms will increase, and corporate farming will decrease in the near future.
4. Careers in animal science require different educational levels.
5. It is possible to become a veterinarian with a two-year college degree.

Multiple Choice

1. About one-third of the employment opportunities for college graduates in food and agricultural careers are in _____.
 - a. marketing, merchandising, and sales
 - b. food processing
 - c. education
 - d. engineering
2. _____ colleges are specialized two-year colleges that offer programs focusing on career and technical education.
 - a. Community
 - b. University
 - c. Graduate
 - d. Technical

3. A _____ is the ability to do something particularly well, often achieved through practice, training, and experience.
 - a. duty
 - b. task
 - c. skill
 - d. rule
4. _____ involves careful inspection of one's skills, talents, and interests.
 - a. Self-analysis
 - b. Awakening
 - c. Self-determination
 - d. Intent
5. What percent of the total labor force in the United States is employed in agriculture-related jobs?
 - a. 2%
 - b. 5%
 - c. 10%
 - d. 18%

Completion

1. A four-year college degree is also called a _____.
2. A _____-year college degree is called an associate's degree.
3. DVM stands for _____.
4. _____ is the practice of starting a new business or organization in response to a recognized need or opportunity.
5. A _____ is a broad group or cluster of careers that share similar characteristics and educational requirements.

Short Answer

1. List five occupations that relate to animal science.
2. What is the current trend in farm size?
3. What is a niche market?
4. Name two current trends that are providing new opportunities in production agriculture.
5. Give an example of a trend in technology and biotechnology.



CHAPTER 3

Safety and Biosecurity



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Explain the importance of safety when working with animals.
- Discuss hazards related to working with animals.
- Discuss environmental hazards related to working in the agricultural industry.
- Discuss the importance of biosecurity.



KEY TERMS

flight zone

zoonotic disease

Material Safety
Data Sheet
(MSDS)

asphyxiating

biosecurity

agrosecurity

bioterrorism

agroterrorism

LANGUAGE CONNECTION

English	French	Spanish	German	Latin
Agriculture	Agriculture	La Agricultura	Landwirtschaft	Cultio
Disease	Maladie	La Enfermedad	Krankheit	Morbus
Parasite	Parasite	El Parásito	Parasit	Parasitus
Warning	Avertissement	La Advertencia	Warnung	Monitus
Caution	Prudence	La Precaución	Vorsicht	Cautio
Danger	Danger	El Peligro	Gefahr	Periculum

Risk Factors in Agricultural Occupations

Working in the agricultural industry, especially working with animals, can be dangerous. Only mining/quarrying occupations have a higher death rate than agricultural occupations. OSHA, the Occupational Safety and Health Act, requires employers to inform employees about safety practices and their rights and responsibilities. OSHA also requires employers to keep accurate records of injuries that happen on the job.

Handling Animals

Workers at livestock operations, veterinary clinics, and other animal occupations are subject to injury by animals and should have special skills in animal handling. Anyone working with animals should be properly trained and be aware of dangerous situations. Livestock are the leading cause of injury on farms and ranches. Some of the most serious accidents occur with bulls and horses. Horses can kick hard enough to break bones or kill humans. Bulls can gore, kick, or step on their handlers. Only experienced personnel should handle or supervise others working with animals. Many injuries can be prevented by knowing the dangers and understanding animal behavior.

Human error causes the majority of accidents with animals. Common errors that often result in

FIGURE 3-1

This is the wrong area in which to stand to brush a horse's tail. This person should stand to the side of the horse.



Courtesy of Blaine Marable

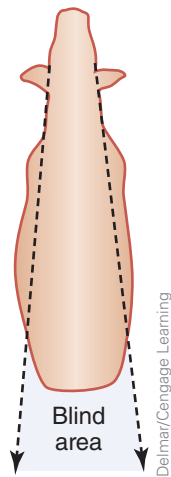
accidents include being tired, not paying attention, poor judgment, and improper animal handling (Figure 3-1). Wearing the proper personal protective equipment is an important safety consideration. All livestock facilities should have a well-equipped first aid kit available to all workers and guests.

Cattle Cattle seldom attack people, but sudden noises may startle them and result in injuries to the handler. As with all animals, cattle should be handled as calmly and quietly as possible. To prevent injury, cattle should never be approached from the side or rear. It is important to be alert to avoid getting kicked. Cattle see a panoramic view of their surroundings because their eyes are located on the sides of their head. This makes them more sensitive to movement in their field of vision. Figure 3-2 illustrates the field of vision in cattle. Cattle have limited



Science Connection

Comparing eye placement in animals can often determine if the animal is a predator or prey. Predators have eyes in the front of their skull. The field of vision of a predator overlaps and gives the predator animal better depth perception and better vision straight ahead. The eyes of prey animals are located on the sides of the skull. The benefit is that prey animals have excellent peripheral vision. The wide range of vision gives them a chance to spot an approaching predator.

**FIGURE 3-2**

Most livestock have a form of binocular vision. This vastly improves their area of vision.

depth perception and see things in various shades of black and white. They may react strongly to contrasting patterns of objects around them.

Swine Hogs are generally not dangerous, but a sow will attack a person if her pigs are hurt or threatened. Never work with small pigs in the same pen as the sow. Calm and quiet handling of swine will help protect the pigs and workers. In addition, hogs do not sweat and will overheat and may die if forced to run for an extended period of time, especially in hot weather.

Sheep and Goats Sheep and goats are generally not considered very dangerous to people. It is possible to be injured by being butted by a ram or buck. Sheep and goats are often injured or killed by predators. Dogs, llamas, and donkeys are sometimes used to protect sheep and goats (Figure 3-3).

Horses Safety rules must be followed when riding or working with horses. Serious injury may result from failure to follow safety rules. Horses are large, strong animals, subject to being startled easily. They often unintentionally hurt themselves and people when trying to get away from a perceived danger. Many states have special regulations regarding the safety of people working with horses.

**FIGURE 3-3**

Livestock guardians are sometimes used to protect livestock from predators.



Delmar/Cengage Learning

FIGURE 3-4

Standing to the side of a horse is the correct way to brush the tail.

Horses have good hearing, but they do not see well directly in front or to the rear. When approaching a horse always speak to the horse to let it know you are approaching. Approach the horse at a 45-degree angle from the shoulder so the horse can see you, and never directly from behind. Pet the horse by rubbing its neck or shoulder and do not reach for the end of its nose. When handling a horse, the most important rule to remember is to stay out of kicking range of the horse. Stand close to the horse when working with it so that any kick will not be at full force. When working with the horse's tail, take a position near the point of the buttock. Stand to the side and face the rear (Figure 3-4). Do not stand directly behind the horse.

Move slowly in a kind but firm manner when working with a horse, such as lifting its feet. Use simple methods of restraint. Tying or holding the head is safest when working with the horse. As with all large animals, protective footwear must be worn around horses to prevent injury.

Companion Animals Companion animals can be dangerous when sick, injured, or agitated and should be handled carefully. Companion animals may bite, scratch, or ram. Do not approach an unknown animal without first asking its owner if it is safe to do so. Veterinarians, veterinary assistants, and technicians must undergo special training on how to handle animals for treatment.

Moving and Transporting Livestock Animals are more dangerous when they are being loaded onto or unloaded from trailers because they are excited, stressed, and confused (Figure 3-5). It is important to have well-designed, sturdy facilities for handling, moving, and transporting livestock.

Animals hesitate to enter what appears to them to be a dead end. For this reason, curved chutes with solid sides and a uniform color make it easier and safer to move animals. Cattle move more easily into headgates and chutes that are open ahead of them. Animals hesitate to enter a darkened building when it

FIGURE 3-5

When loading or unloading animals, extra care should be taken for the safety of the animal and handler.



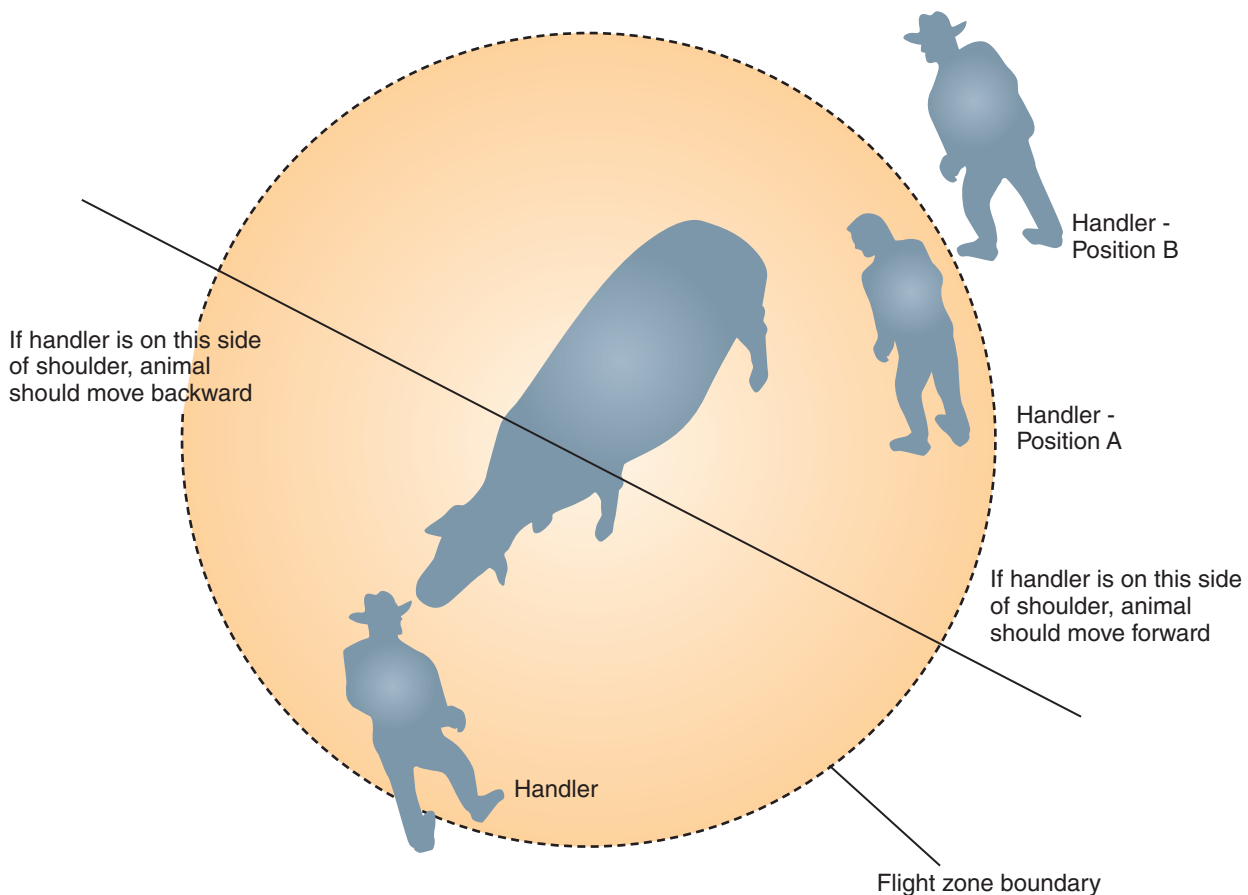
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flight zone

the area surrounding an animal that when entered will cause the animal to retreat and flee

is light outside. Lighting the interior of a truck makes it easier to get animals to move into the truck.

The **flight zone** concept is an imaginary circle around the animal (Figure 3-6). The radius of the circle is fairly small for animals that are comfortable around people and larger for animals that have not



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FIGURE 3-6

Flight zone of cattle.

been handled much. The flight zone for cattle ranges from 5 to 20 feet, varying with the extent that the animal has been handled. The animal will move away if a worker enters the flight zone. The animal will move in a calm, steady manner when the worker stays on the edge of the flight zone. Workers must stay in a position where the animal can see them. By properly positioning themselves near the flight zone, workers can more accurately move animals in the desired direction.

Workers should enter enclosed areas with animals only when necessary. Gates for quick entry or exit of pens should be provided. Catwalks should be a part of chutes and alleys to avoid workers having to enter an area with livestock. Flooring with a rough finish for traction of animals and workers is desirable. The work areas should have adequate natural or artificial lighting.

Hazards of Animal Diseases

zoonotic disease

a disease that can be transmitted from an animal to a human

Diseases that may be transmitted between humans and animals are called **zoonotic diseases**. Some of the more common zoonoses are rabies, trichinosis, salmonella, leptospirosis, ringworm, tapeworm, and spotted fever. Some zoonotic diseases and parasites are very dangerous to humans. It is important to take precautions to prevent these diseases, such as wearing rubber gloves when treating sick animals. Cleanliness, vaccination, quarantine of sick animals, and avoiding exposure are other ways to control diseases. The most important and effective precaution to prevent zoonotic diseases is to thoroughly wash your hands after contact with any animal.

Rabies is perhaps the best known zoonotic disease. Cases of humans developing rabies in the United States are rare, with only about two reported cases per year. However, the disease is nearly always fatal once symptoms appear. There are hundreds of cases each year of humans being exposed. Infected people must undergo special treatment to prevent development of the disease. People who work around animals need to

take precautions against the possibility of becoming infected by the rabies virus. The disease is common and the possibility for human infection is significant.

Pets and livestock are most likely to contract rabies through contact with infected wild animals such as skunks, raccoons, and bats. It is uncommon for dogs to become infected because dogs have almost always been immunized against rabies. The law in most communities throughout the U.S. states that vaccinations must be kept up-to-date for pets, especially dogs and cats, to reduce the danger of rabies infection.

Environmental Hazards

Conditions such as slippery floors and cluttered facilities contribute to dangerous environmental situations. Electric shock is also a potential hazard in damp areas. Lifting heavy loads may cause muscle strains for workers. Equipment and facilities can pose hazards such as manure pits, silos, automatic feeding equipment, and confinement buildings. Dangerous gases may collect inside manure pits and confinement buildings. Proper ventilation is required. A strong knowledge of how to use and operate equipment properly can reduce the risk of bodily injury.

Heat and Humidity Farm workers experience increased health risks when high temperatures combine with high humidity. These conditions may result in heat exhaustion or heat stroke. During hot, humid weather people should take precautions by selecting the proper clothing for the activity and drinking plenty of fluids to help reduce heat-related health problems.

Silo Hazards Silos are dangerous for several reasons. People can fall from the silo or may be injured by equipment used to fill the silo (Figure 3-7). Nitrogen dioxide gas that forms from fermenting green material in the silo can be deadly. Silo gas can be a danger in an unvented silo for several weeks after the silo is filled. Seek medical treatment immediately if exposed to silo gas.



FIGURE 3-7

Grain bins and silos can be hazardous.

Grain Handling and Storage Hazards Workers need to be alert when unloading grain from storage bins and follow safety precautions. Workers may become trapped in the flowing grain. It only takes seconds for a worker to become submerged to the point of helplessness. Within 20 seconds, a worker can become completely covered by grain.

Dust and molds in grain storage areas can cause workers to become sick. Toxic organic dust syndrome can cause symptoms much like those of the flu—coughing, fever, chills, headaches, muscle aches, shortness of breath, and fatigue.

Livestock Confinement Building Hazards Workers in livestock confinement buildings must exercise caution because of the danger from toxic gases. Proper ventilation of these buildings is especially important.

Toxic gases such as ammonia, methane, hydrogen sulfide, and carbon monoxide may become concentrated in livestock buildings. These gases, with the exception of ammonia, are heavier than air and sink to the bottom of manure pits. This forces oxygen out of the area and creates a dangerous situation. It only takes one to three breaths of hydrogen sulfide to kill a person if the gas is present in a high concentration.



DANGER = Highly Toxic

WARNING = Moderately Toxic

CAUTION = Least Toxic

FIGURE 3-8

All chemicals must include one of the three signal words based on their toxicity. The word "DANGER" can also appear with the word "POISON" and the skull and crossbones symbol above.

Material Safety Data Sheet (MSDS)

an informational sheet prepared by the manufacturer of a chemical with all the requirements for storage, use, handling, and safety clearly spelled out

Delmar/Cengage Learning

Chemical Hazards

To reduce the health risks associated with pesticide use, the Environmental Protection Agency (EPA) requires that workers be trained in safe pesticide handling methods related to the use of these chemicals. The EPA requires that labels on pesticides provide information that employers and employees need about the safe use of the pesticide (Figure 3-8).

All workers must read the label and understand the instructions for application before working with chemicals. The container label should also give instructions on the appropriate disposal and cleanup if a spill occurs, as well as proper first aid treatment. Directions for storage can be found on the label. Chemicals should be kept secure, in their original container, away from children, and at the appropriate temperature.

Material Safety Data Sheets (MSDS) contain information on the correct procedures for handling chemicals. OSHA requires that the MSDS be available for each chemical at the work site. MSDSs contain information on toxicity, storage, disposal, proper protective equipment, cleaning of protective equipment, and how to handle a spill. The MSDS will include signal words to alert workers to the toxicity level of each chemical. One of three words is used: CAUTION, WARNING, or DANGER. If the label says CAUTION, the chemical is slightly toxic. If the label says WARNING, the chemical is moderately toxic. If the label says DANGER/POISON, the chemical is highly toxic.

Personal Protective Equipment

The appropriate personal protective equipment (PPE) should be used when handling certain chemicals or when other hazards are present (Figure 3-9). Respirators are masks that are worn to prevent pathogens and pollutants from entering the worker's



Delmar/Cengage Learning

FIGURE 3-9

Personal protective equipment (PPE) includes contamination suits.



Delmar/Cengage Learning

FIGURE 3-10

Respirators should be worn in dusty areas or when working with chemicals.

asphyxiating

to deprive of oxygen, causing unconsciousness or death

biosecurity

protecting living things from biological harm such as diseases, pests, and bioterrorism. In agriculture, it is sometimes referred to as **agrosecurity**

mouth and nose. Respirators should be used in dusty conditions, in silos, manure storage areas, and when handling moldy feeds (Figure 3-10). Goggles are worn to protect the eyes from dust, chaff, and chemicals. Protective gloves should be worn around sick animals or when assisting at birth. Shoe covers are helpful in preventing the spread of disease from farm to farm, and many producers require them before coming onto the farm property.

Livestock workers are exposed to three types of atmospheric contamination; dust, pesticides, and toxic gases. Dust and particulate matter come from feed, animal hair, and fecal matter. Pesticides used in treating livestock may cause health problems when inhaled by workers. Toxic and asphyxiating gases are produced in liquid manure storage pits. **Asphyxiating** gases are the gases that deprive the uptake of oxygen by the body and may cause death. The four main kinds of dangerous gases produced are ammonia, hydrogen sulfide, methane, and carbon dioxide.

Biosecurity

Assuring security of the nation's food supply is a major responsibility of producers and is of major importance to every citizen. One incidence of disease could be economically disastrous for a producer. Some diseases, such as foot and mouth disease, could spell disaster for an entire industry. Almost six million cattle had to be destroyed in the 2001 outbreak of foot and mouth disease in the United Kingdom. Avian influenza (bird flu) and H1N1 (Swine Flu) could destroy the poultry and swine industries, as well as kill millions of humans. Since there are no vaccines for some diseases, including foot and mouth disease and avian influenza, **biosecurity (agrosecurity)** is the only line of defense.

Bovine Spongiform Encephalopathy (BSE), also known as Mad Cow Disease, is another infamous zoonotic disease. Although no humans have been

affected in the United States, health concerns were raised by the media throughout the country. As of 2009, there have only been three confirmed cases of cattle being infected with BSE in the United States. The European cattle industry, where BSE was first detected, was most affected. New legislation has been passed preventing the feeding of meat, meat by-products, and bone meal to production livestock to prevent any further transmission of the disease.

Many terms are used to describe the deliberate or incidental harm to the food production system and the precautions taken for prevention.

Damage to the agriculture industry could come from insects, diseases, and chemicals, among other threats. These agents of destruction could be spread naturally through animals, wind, accidentally through the movement of people, vehicles, and equipment, or deliberately as an act of terrorism. An act of terrorism targeting a nation's food supply is termed **bioterrorism** or **agroterrorism**. Anything a producer does to prevent such destruction can be considered biosecurity.

While biosecurity measures are taken at both the national and state levels to prevent outbreaks of diseases and other destructive agents, it is most important to start at the producer level. It is necessary that producers implement programs that prevent diseases and other destructive agents from entering their herds and spreading. To help prevent diseases from entering the herd, producers should buy healthy animals, and, once at the farm, keep new animals away from their other herds for 10 to 30 days (Figure 3-11). This quarantine period allows the livestock producer or manager to detect any disease or parasite problems that the animals may have, and to prevent exposure to other animals. Here are some helpful tips that livestock producers may use to help prevent disease.

- ▶ Keep newly purchased animals away from other animals for 10–30 days.
- ▶ Keep the farm clean. Proper disposal of manure is essential. For poultry and swine

bioterrorism

the deliberate use of biological or chemical weapons. In agriculture, it is sometimes referred to as

agroterrorism



FIGURE 3-11

Keeping healthy animals away from diseased or infected animals is imperative for producers.

facilities, only enter with clean, disinfected attire and keep all cages and pens clean.

- ◀ Do not bring diseases home. Disinfect equipment used at another facility and minimize contact of animals with other animals at shows, across property lines, etc.
- ◀ Know the early warning signs and symptoms of diseases.
- ◀ Report sick animals to a local veterinarian and/or a state veterinary department.
- ◀ Maintain closed herds or flocks as much as possible by limiting visitors around the animals and facilities.

Summary

Many factors influence the dangerous situations that may arise from working with animals. Injuries could be caused by animals, chemicals, fire, diseases, poor ventilation, or facility conditions. Understanding safety precautions will reduce the number of accidents in agricultural occupations.

To prevent injury, it is important that all workers be familiar with the correct handling procedures when working with animals. Domestic animals are usually not aggressive, but may attack if startled or stressed, especially when being loaded and unloaded or to defend their young. Workers should

use the “flight zone” concept to move animals and avoid approaching an animal from a position where the animal cannot see the person approaching.

Zoonotic diseases, such as rabies, may be transferred between humans and animals. Preventative measures such as cleanliness, vaccination, and quarantine should minimize the risk of infection. Hand washing after handling animals is the single most important thing to help prevent infection from zoonotic diseases.

Facilities, especially grain bins, silos, and confinement livestock buildings, should be checked for safety. Protective equipment should be worn when necessary. First aid kits containing the proper medical supplies should be kept in the home, in livestock buildings, on all major pieces of equipment, and in all vehicles.

Workers should be trained in the proper use of chemicals. Material Safety Data Sheets (MSDS) contain information on the handling and disposal of chemicals, and one should be provided for every chemical used on the work site.

The deliberate or incidental harm to the food production system has been an increasing concern in the agriculture industry in recent years. It is important for animal producers to employ biosecurity techniques to prevent the spread of disease in their herds, and thus ensure a safe food supply.

Quick Facts

- The leading cause of injuries on farms is from livestock.
- The Environmental Protection Agency (EPA) requires that workers are trained to safely handle pesticides.
- Material Safety Data Sheets (MSDS) contain information on procedures for handling any chemical on the work site.
- A combination of high heat and high humidity is a common danger to agricultural workers.
- Livestock seldom attack people. However, they may attack when startled, stressed, or protecting their young.
- Curved chutes that have solid sides and are a uniform color make it easier and safer to move livestock.
- The flight zone is an imaginary circle around an animal. The flight zone for cattle generally ranges from 5 to 20 feet. An animal will move away if a person enters their flight zone.

- Approach a horse at a 45-degree angle from the shoulder, never directly from behind.
- Diseases that may be transmitted between man and animals are called zoonotic diseases.
- Safety measures should be considered when working in or around silos, grain bins, or livestock confinement buildings.
- Bioterrorism is the intentional use of any weapon such as chemicals, biological agents, and explosives against the nation's agricultural and food industries.

Student Learning Activities

1. Have an extension agent or other knowledgeable person talk to the class about biosecurity and bioterrorism.
2. Visit a farm that uses biosecurity measures.
3. Have students write out some general farm safety rules.
4. Visit a laboratory that is using biosecurity methods.
5. Have students brainstorm about the possible havoc that could be caused by bioterrorism.

Discussion Questions

1. Why is it important to keep livestock facilities well-ventilated?
2. Why is biosecurity so important to our country?
3. What role do environmental factors play in farm accidents? How can they be prevented?
4. What is bioterrorism? How can it be prevented?
5. What areas should a person avoid when dealing with livestock?

Review Questions

True/False

1. Jobs in the agriculture field are some of the safest jobs in America.
2. Material Safety Data Sheets contain information on procedures for handling any chemical on the worksite.

3. The eyes of most livestock species are located at the front of their skull, giving them excellent depth perception.
4. Nitrogen dioxide gas can form from storing green material in silos, causing a potential danger for workers.
5. The EPA regulates the use of pesticides.

Multiple Choice

1. If a label says WARNING, this indicates that the chemical:
 - a. is slightly toxic
 - b. is moderately toxic
 - c. is extremely toxic
 - d. can be washed off the skin easily
2. Diseases that may be transmitted between man and animals are called:
 - a. quarantine
 - b. rabies
 - c. zoonoses
 - d. leptospirosis
3. The _____ is a government agency that works to promote human health and the environment, and also regulates pesticide use.
 - a. Ecological Protection Agency
 - b. Environmental Protection Agency
 - c. Federal Drug Administration
 - d. Federal Pesticide Administration
4. What is the term for the deliberate use of biological or chemical weapons to bring harm to agricultural enterprises, sometimes referred to as agroterrorism?
 - a. Biovision
 - b. Bioterrorism
 - c. Agricultural disaster
 - d. Biosecurity
5. How long should new animals be kept in quarantine?
 - a. 60 days
 - b. 30–50 days
 - c. 10–30 days
 - d. 7–10 days

Completion

1. _____ diseases are those diseases that can pass from livestock to humans.
2. MSDS stands for _____.
3. _____ can be caused by animals, chemicals, fire, diseases, poor ventilation and facility conditions.
4. _____, a gas that can form during fermentation of plant material in a silo can be deadly.
5. Rabies is caused by a _____.

Short Answer

1. List three ways to avoid accidents when working with livestock.
2. What type of personal protective equipment may be necessary when working with animals or in animal facilities?
3. What is the most important rule to remember when working with horses?
4. What precautionary measures may be taken to prevent the spread of zoonotic diseases?
5. What three types of atmospheric contamination are livestock workers exposed to?



CHAPTER 4

Animal Science and the Environment

OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe environmental problems related to animal production.
- Explain animal production practices that decrease possible environmental pollution.
- Describe appropriate ways to dispose of dead animals.
- Outline consumer concerns about animal agriculture.
- Identify government agencies that regulate animal agriculture.

KEY TERMS

environmental
stewardship
surface water
lagoon
greenhouse gas
organic matter
masking agent
counteractant

deodorant
digestive
deodorant
composting
rendering plant
genetically
modified
organism (GMO)

Environmental
Protection
Agency (EPA)
Clean Water Act
point source
non-point source
Clean Air Act

LANGUAGE CONNECTION

English	French	Spanish	German	Italian
Efficiency	Efficacité	La Eficiencia	Effizienz	Efficienza
Compost	Compost	El Compost	Kompost	Concime
Pollution	Pollution	La Polución	Verschmutzung	Polluzione
Greenhouse Gas	Gaz à Effet de Serre	El Gas de Efecto Invernadero	Treibhausgas	Gas a Effetto Serra
Livestock	Bétail	El Ganado	Viehbestand	Bestiame

Protecting the Environment

Animal producers must be aware of environmental issues and obey environmental laws and regulations. It is difficult to keep up with the ever-increasing federal, state, and local environmental regulations. Legal action against farmers damaging the environment, even if their actions are unintentional, is increasing. Penalties can devastate an animal production business.

“Right to Farm” laws have been passed in every state due to the migration of people from the city into rural areas where farms are nearby. It has become common for subdivisions to be built next to livestock and poultry farms, creating friction between the homeowners and farmers over odor, flies, and other issues. The “Right to Farm” laws were designed to strengthen farmers’ legal rights to farm

FIGURE 4-1

People moving into rural areas should be aware of local agricultural enterprises.



environmental stewardship

the responsible use and care of
environmental resources

and prevent nuisance lawsuits against farmers (Figure 4-1). The “Right to Farm” laws, however, do not give farmers the right to disobey environmental laws and regulations. Farmers must be good stewards of the environment, as all citizens should be. **Environmental stewardship** is the responsible use and care of environmental resources.

Right to Farm Legislation

The following paragraph shows the easy-to-understand wording used in the Right to Farm legislation.

“It is the policy of this state and this community to conserve, protect and encourage the development and improvement of agricultural land for the production of food, and other products and also for its natural and ecological value. This notice is to inform prospective residents that the property they are about to acquire lies partially or wholly within an agricultural district and that farming activities occur within the district. Such farming activities may include, but not be limited to, activities that cause noise, dust and odors.”

This notice shall be provided to prospective purchasers of property within an agricultural district, or on property that has boundaries within 500 feet of a farm operation located in an agricultural district.

The three most common environmental problems for farmers are animal waste disposal, odor control, and dead animal disposal. Producers must deal with these problems in ways that do not harm the environment.

Animal Waste Disposal

Animal wastes are a growing problem, not only for farmers, but also for society.

Animal wastes may pollute groundwater, streams, and lakes. A certain amount of livestock odor and waste is a natural part of livestock production. A poultry farm of 200,000 hens may produce as much waste as a city of 20,000 people. Farmers must be able to manage waste and minimize pollution while still maintaining production and profitability.

Livestock producers must dispose of waste without creating health or safety hazards for people or other animals. The main objective of manure handling is to prevent **surface water** and ground water pollution. Other nuisances caused by manure include odors, flies, and rodents.

At one time, animals were raised predominantly on pasture, and their manure would be distributed over a wide area without any problems. But because of the increase in confinement animal production, the concentration of manure in small areas has become a major problem. A modern poultry house holds over 20,000 chickens, while a dairy may keep hundreds of cows confined under one roof. These types of confinement operations create huge amounts of manure in a relatively small area, making disposal of the manure difficult.

Manure must be disposed of or recycled in some way. Farmers have been recycling manure for centuries by using it as fertilizer or compost. It is always a good idea to consult local, federal, and state agencies about waste disposal during the planning stages of a livestock production system.

Animal manure may be collected and handled as a solid or a liquid. Liquid systems use pits or lagoons to store manure. Pits are pumped out, and the manure is applied to crop land. A farm **lagoon** is a pond of water for holding animal waste (Figure 4-2). Anaerobic bacteria in a lagoon decompose manure, which may then be pumped from the lagoon and applied to fields.

surface water

water sources, such as rivers, streams, and lakes, that are found above ground

lagoon

a pond of water; in farming this can be used to hold animal waste

**FIGURE 4-2**

A manure lagoon at a swine facility.

greenhouse gas

an atmospheric gas that absorbs and emits heat

The final step in most disposal systems is to apply the waste to the land as fertilizer. When commercial fertilizers were inexpensive, the value of animal manure was low. With the increasing cost of chemical fertilizers and the movement toward organic farming, animal manure has become more valuable as a fertilizer.

Greenhouse Gas Emissions **Greenhouse gases** are gases in the atmosphere that absorb and emit heat. Methane (CH_4) is a common greenhouse gas that may contribute to global climate change. As part of their natural digestive process, ruminant animals give off a substantial quantity of methane gas as a by-product. Livestock, especially cattle, are thought by some to be one of the biggest sources of methane gas pollution. This point is highly controversial. While methane can be a problem for the atmosphere, other gases emitted in the production of animals include nitrous oxide and carbon dioxide, both of which are greenhouse gases.

Beyond the environmental effects, methane production in animals is wasteful. An estimated 5 to 15 percent of the digestible energy in feed for livestock is wasted in the form of methane gas emissions. This is an important concern for livestock producers. If the amount of methane produced by cattle could be decreased, less feed would be needed for the same amount of weight gain. Animal scientists are researching ways to reduce methane gas production.



Science Connection

Methane lives for 9–15 years in the atmosphere, and it is over 20 times more effective at locking in heat in the atmosphere than carbon dioxide. Most of a cow's methane emissions result from belching, but methane is also emitted by flatulence.

organic matter

a decaying substance that originated from a once-living organism

Impact of Manure Management Systems on the Environment

High levels of methane gas are emitted from operations that manage manure as a liquid. Methane is given off when the high concentrations of **organic matter** found in manure pits and lagoons are under anaerobic conditions, having little contact with the air. Manure that is managed as dry matter does not release as much methane as liquefied manure. Collecting methane gas from livestock waste and using it as a fuel source is an emerging technology that helps reduce manure disposal problems.



Science Connection

Mass transit is getting a makeover in Sweden, thanks to cows. After harvest, the non-consumable portions of cows such as fat and organs are transported to a biogas plant where they are decomposed, and methane is extracted. Each cow can supply 2.5 miles of travel for the train. The biogas releases much less carbon dioxide than conventional fossil fuels.

Odor Control

A major problem with animal production is the odorous gases given off by manure. Gases and odors can be reduced by mixing air with the manure. In liquid manure systems, this is done by installing equipment to force air through the liquid. In solid manure systems, it is more difficult to prevent gases and odors from forming. Figure 4-3 shows a system to help separate solid from liquid waste.

Odor-control products can be used for animal manure. There are four types of odor-control products: (1) masking agents, (2) counteractants, (3) deodorants,

FIGURE 4-3

There are varying methods used to effectively contain and control manure waste. In this system, most solids are separated before the water enters the lagoon.



Courtesy of Shannon R. Lawrence

masking agent

a product that covers up odors by introducing another odor

counteractant

a product that neutralizes the odor

deodorant

a chemical product that kills bacteria causing odor

digestive deodorant

contains bacteria that create a digestive process that eliminates odor

and (4) digestive deodorants. Use of these products may be necessary to prevent complaints from neighbors and possible legal action against the farmer.

Masking agents cover up the odor of wastes with the introduction of another odor. They are considered the most effective of the four types of odor control. **Counteractants** attempt to neutralize the odor. **Deodorants** are chemicals that kill the bacteria that cause the odor. **Digestive deodorants** contain bacteria that create a digestive process that eliminates the odor.



Science Connection

Smell is one of the five major human senses. Everything you smell has given off molecules into the air and those molecules have entered your nose. Whether fresh baked cookies, onions or manure, the molecules from that material have evaporated and are floating in the air. Things that do not evaporate easily such as steel, sugar, and concrete are not easily smelled. Humans can detect about 10,000 different odors.

Disposal of Dead Animals

Animals that die of disease, accidents, or natural causes create disposal problems. It is the responsibility of the owner to dispose of the carcasses in a way that does not create a health or environmental problem. Bacteria, viruses, and other disease-causing organisms may spread from dead animals to people,

or to other animals. Internal and external parasites from dead animals are another concern. The laws governing the disposal of dead animals can vary on a state-by-state basis, although most states have laws that require the disposal of dead animals within 24 to 48 hours. Rendering plants, burying, incineration, and composting are approved disposal methods that are typically used.

composting

a natural process used to break down organic materials in an aerobic setting

Composting **Composting** is a natural process by which organic materials are broken down in an aerobic setting where oxygen is present. Fungi, bacteria, and other microorganisms decompose materials into compost. Composting is the most common method of dead bird disposal in the poultry industry (Figure 4-4). Pig carcasses are commonly composted as well, and the composting of cattle is becoming more common.

A structure for composting should have a concrete floor and a roof to protect the material. A variety of materials may be used to cover the carcasses in a composting bin. These materials include sawdust, wood chips, ground corn cobs, wood shavings, or poultry litter. A properly constructed compost pile does not give off excessive odors or attract flies and rodents. The animal carcasses are placed on a layer of composting material, and then more composting material is added on top. This layering process continues until the bin is full. The finished, composted product is safe to spread on fields as fertilizer and as a soil amendment.



FIGURE 4-4

Poultry litter stack houses are used to compost dead chickens and litter before this waste is applied to pastures and crops.

Courtesy of Gary Farmer

rendering plant

a facility that uses the parts of dead animals and converts them into usable products; also known as a rendering facility

Rendering Plants **Rendering plants** or **rendering facilities** extract materials from animal carcasses and convert them into a variety of valuable products; the plants “recycle” parts of dead animals leftover from harvest. Rendering plants serve two major purposes: to provide a low cost food source for animal feed and to dispose of carcasses (Figure 4-5). A meal, such as bone meal, consists of the remnants of bone after the water and fat have been removed and the bones have been crushed. Rendering plants produce meal from feathers, bones, blood, and other parts of the carcass. Specific kinds of meal are then used for products such as soap or feed for livestock, pets, and poultry. Rendering plants are monitored by the USDA Food Safety and Inspection Service.

**Science Connection**

Much of the product from edible rendering plants is used in pet food. The term “meat meal” is used on pet food labels. Meat is composed of 75 percent water. In rendering plants, most of the fat and water is removed from the product by rendering.

Incineration Burning animal carcasses can be difficult, odor-causing, and expensive for larger animals. Small animals such as young pigs and young



FIGURE 4-5

Animal by-products, such as meat and bone meal, may be used when producing pet food.

Courtesy of Shannon R. Lawrence



Delmar/Cengage Learning

FIGURE 4-6

An incinerator. Burning of animal carcasses is effective but expensive, especially for large animals.

genetically modified organism (GMO)

an animal, plant or micro-organism that has been modified by genetic means

chicks are about the only animals that are a practical size for incineration (Figure 4-6). Incineration units are expensive to purchase and to operate and maintain. State laws regulate the construction and operation of incinerators.

Burial If an animal is to be buried, the carcass should be buried 4 feet or deeper, and the site should have good drainage. Many producers do not have the equipment needed to dig holes for large animals. Burying dead animals can become labor-intensive and expensive for the producer. The burial site should be away from water sources such as wells, springs, and streams. State laws regulate the process of animal burial.

Other Environmental Concerns

The use of antibiotics, feed additives, clones, hormones, and **genetically modified organisms (GMO)** in livestock production are concerns of many consumers. Some consumers believe that these substances and techniques may affect the safety of the food supply and harm the environment. However, the FDA requires that all foods be tested extensively to maintain safety and meet environmental standards.

Antibiotic Use

Some consumers fear that antibiotic residues remain in meat and milk products when consumed by humans (Figure 4-7). By law, all milk is tested for antibiotics, and no amount of antibiotic residue is permitted in milk sold for human consumption. Research conducted by the FDA and USDA has shown that if producers administer medications in the proper amount and observe withdrawal times, antibiotic residue does not occur in animal products.

Another consumer concern is that the overuse of antibiotics may lead to bacteria that are resistant



Courtesy of USDA, Steven Alasmus

FIGURE 4-7

Milk is tested at the farm and several times at the processing plant to ensure human safety.

to antibiotics. Since humans and animals use the same antibiotics, resistant bacteria could lead to serious health problems in the population. This is a highly debatable issue, but a concern for producers, as some groups advocate a complete ban on antibiotic use in agriculture.

Genetically Modified Organisms and Clones

Developments in biotechnology have created concern among many consumers. Some people feel that the consumption of genetically altered animals can be harmful to their health. Proponents of genetic engineering, on the other hand, claim that genetic engineering has been practiced ever since the domestication of animals through the process of selective breeding.

The cloning of production animals is not economically feasible at this time, although new technologies could make it easier to use and more cost-efficient. The most current use of cloning is for research purposes and the occasional companion animal owner. This technology is strictly regulated by the USDA and heavily scrutinized by consumers.

Use of Hormones and Feed Additives

Other advances in biotechnology, such as the use of hormones to increase milk production, have caused concern among some consumers as well. Although the National Institutes of Health and the Food and Drug Administration have declared the hormones safe for both the cows and human consumers of milk, the use of genetic engineering and biotechnology in food production is still controversial.

Feed additives are divided into two categories, nutritive and non-nutritive. Nutritive feed additives add something to the animal's diet that is nutritious,

such as vitamins and minerals. Non-nutritive feed additives usually contain medications to help the production animal stay healthy. These non-nutritive additives include medications for coccidiosis, scour, bloat, worms, and respiratory disease.

Environmental Regulations

Environmental Protection Agency (EPA)

the federal agency in charge of regulating environmental policies

Clean Water Act

legislation regulating water pollution; prohibits release of contaminants into a stream or river

point source

an identifiable source of pollution

non-point source

a source of pollution that is hard to trace

Clean Air Act

legislation that regulates air quality standards

The **Environmental Protection Agency (EPA)** is the main regulatory agency for environmental policy in the United States. The EPA is a federal agency that is responsible for protecting human health by maintaining the natural environment. Livestock producers must be aware of EPA regulations and the regulations of related state agencies to ensure that proper production procedures are being practiced.

The **Clean Water Act** is the main federal law that regulates water pollution. The law prohibits the release of any pollutants from a point source into a river or stream without a permit. A **point source** of pollution is any identifiable source, such as a feedlot or chicken house (Figure 4-8). A **non-point source** is a source of pollution that is harder to trace, such as debris that has been blown by the wind. The EPA monitors several water pollutants that can deplete oxygen levels, transmit diseases, and create undesirable odors and appearance of the water. For animal producers, these water pollutants would mostly be manure and dead animals.

The **Clean Air Act** establishes national air quality standards. This act makes the states primarily responsible for making sure that these air quality standards are met, maintained, and enforced. Each state has an agency similar to the EPA to enforce environmental laws and regulations. Most states have laws that deal with nuisances, such as odors, dust, chemicals, water pollution, disposal of dead animals, and animal noises.

**FIGURE 4-8**

Feedlots and other livestock facilities must follow strict guidelines for runoff.



History Connection

In July of 1970, the Environmental Protection Agency (EPA) was established by former President Richard Nixon and Congress to answer public requests for cleaner water, air, and land. Not only is the EPA responsible for fixing environmental damage that has already been done, but it is also responsible for establishing new standards for a cleaner America.

Summary

Farmers have to maintain production while following increasing environmental laws and regulations. Agricultural wastes are a growing problem for producers and a threat to the environment. Greenhouse gases, especially those given off by cattle and manure, are also a growing concern for livestock producers.

Livestock producers must dispose of animal wastes in a way that is not hazardous to people, animals, or the land. There are several ways of handling livestock wastes. Different manure management systems have different effects on the environment. Animal manure emits potentially dangerous gases and odors.

Livestock producers are also faced with the issue of disposing of dead animals. Any carcass disposal method must meet local, state, and federal regulations.

There are several state and federal regulatory agencies that monitor pollution to the water, air, and land.

Quick Facts

- Livestock producers must be constantly aware of environmental issues, laws, and regulations.
- “Right to Farm” laws are present in all 50 states. These laws were enacted as a result of people moving into agricultural areas.
- The three most common environmental problems for farmers are waste disposal, odor control, and the disposal of dead animals.
- Methane is a common greenhouse gas. Methane may be captured and used as an alternative fuel.
- The Environmental Protection Agency (EPA) is the main regulatory agency for environmental policy in the United States.
- The main objective of manure handling is to prevent surface and ground water pollution.
- A lagoon is a pond of water for the storage and decomposition of animal waste.
- Manure may be used as a fertilizer and for a soil amendment.
- There are four types of odor-control products used when dealing with animals: masking agent, counteractant, deodorant, and digestive deodorant.
- Farmers, as all citizens, should be stewards of the environment.
- Dead animals may be disposed of by burying, composting, incinerating, or processing at rendering plants.
- There are a variety of public concerns about animal production including odor control, environmental damage, antibiotic use, GMOs, hormone use, cloning, and feed additives.

Student Learning Activities

1. Present an oral report on one phase of animal production as it relates to the environment.
2. Survey the local community to determine what problems farmers have experienced relating to livestock and the environment, and how these problems were solved.

3. Interview farmers to learn their views about current laws and regulations relating to animal production and the environment.
4. Follow all applicable environmental laws when planning and conducting a supervised animal experience program.
5. Interview adults in the community, who are not livestock producers, to determine their views on Right to Farm laws.

Discussion Questions

1. What changes have occurred in livestock production in recent years that have increased environmental problems?
2. Explain the value of livestock manure when it is used as a fertilizer or soil amendment on crops.
3. Describe how gases and odors from livestock wastes may be controlled.
4. List and describe three disposal methods for dead animals.
5. Describe the notice given to people moving into agricultural production areas by the “Right to Farm” laws.

Review Questions

True/False

1. Federal, state, and local regulations have a major impact on animal production practices.
2. The Clean Water Act does not apply to animal agriculture.
3. States do not regulate the disposal of dead animals; it is the responsibility of each individual farmer to dispose of dead livestock in a safe and proper manner.
4. Methane, nitrous oxide, and carbon dioxide are all greenhouse gases.
5. Most manure is eventually applied to the land as fertilizer.

Multiple Choice

1. GMO stands for:
 - a. germ modified organism.
 - b. genetically modified organism.
 - c. generally methane odor.
 - d. genetically melodious organism.

2. A _____ holds liquid waste on farms.
 - a. lagoon
 - b. confinement facility
 - c. trough
 - d. run-off
3. A facility that extracts materials from animal waste products from processing plants and from animals that die of natural causes and disease, and converts them into useful products is called a(n) _____ plant.
 - a. extraction
 - b. rendering
 - c. changing
 - d. converting
4. The most common way of disposing of dead birds in the poultry industry is _____.
 - a. burying
 - b. burning
 - c. composting
 - d. drying
5. A decaying substance that originated from a once-living organism is referred to as _____.
 - a. organic matter
 - b. point source
 - c. inorganic matter
 - d. methane

Completion

1. A _____ or pit may be used to store manure in liquid form.
2. Some people do not want antibiotics to be given to food animals because they fear that some bacteria may become _____ to antibiotics.
3. The three most common environmental problems for farmers are animal waste disposal, odor control, and _____ animal disposal.
4. The _____ _____ is the main regulatory agency for environmental policy in the United States.
5. Use of odor control products may be necessary to avoid complaints from neighbors about odors and possible _____ against the farmer.

Short Answer

1. How is antibiotic residue prevented from contaminating milk and meat products?
2. What types of risks do dead animals present to humans?
3. Why were the “Right to Farm” laws passed?
4. What are the two broad types of feed additives?
5. Why is incineration usually not used in dead animal disposal?



Section 2

ANATOMY, PHYSIOLOGY, FEEDING, AND NUTRITION

CHAPTER 5 Anatomy and Physiology

CHAPTER 6 Animal Nutrition and Feeding

FFA AND 4-H CONNECTION



The following is a partial list of activities in which a student may participate using knowledge obtained from a livestock or companion animal program. Students should consult local and state youth organizations, such as the National FFA Organization and 4-H, to determine livestock-related programs available in their area.

- Agriscience Fair
- Animal Nutrition
- Food Science and Technology
- Junior Livestock Shows
- Livestock Evaluation
- Meats Evaluation and Technology

Proficiency Awards (FFA)

- Agricultural Education
- Agricultural Sales
- Agricultural Services
- Diversified Livestock Production
- Veterinary Medicine





CHAPTER 5

Anatomy and Physiology

OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Name and describe the functions of the skeletal system.
- Name and describe the functions of the muscular system.
- Name and describe the functions of the respiratory system.
- Name and describe the functions of the circulatory system.
- Name and describe the functions of the digestive system in ruminant and non-ruminant animals.
- Classify farm animals as ruminant or non-ruminant.

KEY TERMS

anatomy
physiology
cell
unicellular
multi-cellular
tissue
organ
organ system
cartilage
osteon
muscle
skeletal muscle
myoglobin

smooth muscle
cardiac muscle
artery
vein
red blood cell
hemoglobin
white blood cell
antigen
oxidation
respiration
digestion
saliva
enzyme

amino acid
omasum
abomasum
crop
proventriculus
gizzard
estrus cycle
ovulation
ovary
placenta
parturition
afterbirth

LANGUAGE CONNECTION

English	French	Spanish	German	Latin
Cow	Vache	La Vaca	Kuh	Bos
Cattle	Bétail	El Ganado	Rinder	Pecuarious
Ruminant	Ruminant	El Rumiante	Wiederkäuer	Rumino
Bone	Os	El Hueso	Knochen	Osseus
Anatomy	Anatomie	La Anatomía	Anatomía	Anatomia
Mammal	Mammifère	El Mamífero	Säugetier	Mammalis
Skeleton	Squelette	El Esqueleto	Skelett	N/A

anatomy

the study of the structure, shape, and form of organisms

physiology

the study of the functions of the body

Anatomy and Physiology

The practical application of **anatomy** and **physiology** is helpful in the selection and care of domesticated animals. Animals are judged on their anatomy and physiology, whether in the show ring or for breeding purposes (Figure 5-1). Anatomy and physiology affect the ability of an animal to be strong and productive. For instance, a dairy cow with weak legs will have a shorter productive life. A race horse must have the correct anatomical features to be a winner, as well as the proper physiology for its body to handle the strain of racing.

FIGURE 5-1

Anatomy and physiology are not only judged in the show ring, but are also important in selecting breeding stock.



Courtesy of Ray Herren

Cells, Tissues, and Organs

cell

the building block of an organism

unicellular

consisting of one cell

multi-cellular

consisting of many cells

The building block of organisms is the **cell**. Some organisms are **unicellular**, which means they have only one cell. Bacteria and amoebas are examples of one-celled organisms. An unfertilized bird egg is a unicellular organism (Figure 5-2). Most organisms are **multi-cellular**, which means they have more than one cell.

As animal cells divide and grow, they combine and organize themselves into tissues that have a variety of functions. Tissues are groupings of cells that carry out a specific function. Animal tissues include:

- ◀ Muscle tissues which allow the animal to move. Muscle tissues are the major portion of consumable meat.
- ◀ Connective tissues which hold other tissues together. For example, muscle tissues are covered by a sheath of connective tissue. Bones are also classified as connective tissue.
- ◀ Nerve tissues are bundles of tissues that transmit information throughout the body.
- ◀ Epithelial tissues form the covering for most of the internal and external surfaces of the body and its organs. Skin is an example of epithelial tissue.
- ◀ Fluid tissue. Blood is an example of a fluid tissue.

The **tissues** of an animal's body group together to form **organs**. Organs are groupings of tissues that perform one or more special functions in the

tissue

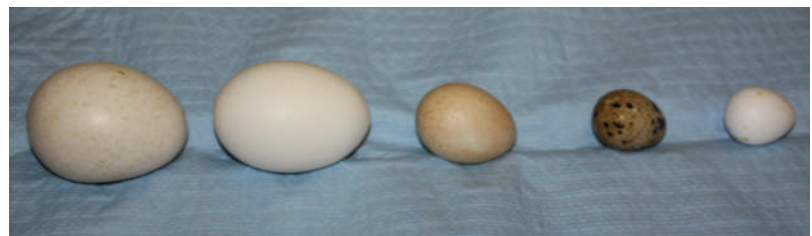
grouping of cells that carry out a specific function

organ

groupings of tissues that perform a specific function (e.g., the heart)

FIGURE 5-2

An unfertilized poultry egg is a unicellular (one cell) organism no matter the size. L to R: Turkey egg, Chicken egg, Chukar Partridge egg, Japanese Quail egg, and Bob White Quail egg.



organ system

a group of organs that work together to carry out particular body functions

body. Organs include the heart, ears, eyes, lungs, and stomach. An **organ system** is a group of organs that work together to carry out a particular task.

Practical Application of Anatomy and Physiology

The most important factor in a profitable cow-calf operation is to maintain a high calving percentage. A low herd calving percentage is usually related to a problem with the bull. The bull should be evaluated for his ability to breed. The bull must be able to move properly in order to breed. Physiological problems may make a bull slow to breed. Poor eyesight can cause the bull to overlook cows in heat. Other physiological problems include, but are not limited to, sore feet, injured legs, poor joints, or any physical ailments that may cause discomfort to the bull.

Systems of the Body

There are many organ systems and several organ sub-systems within the body that work together to support animal health, movement, and production. Each system is similar in structure and function among all species, although there are also differences between species that can define the care given to those animals.

Systems of the body include the skeletal, nervous, muscular, circulatory, respiratory, reproductive, digestive, excretory, integumentary, immune, and endocrine system.

Skeletal System

The skeletal system of mammals is composed of bones, cartilage, teeth, and joints. The functions of the skeletal system are support, protection, storage

Body Systems

1. Skeletal
2. Nervous
3. Muscular
4. Circulatory
5. Respiratory
6. Reproductive
7. Digestive
8. Excretory
9. Immune
10. Endocrine
11. Integumentary

did you know?

Since avian bones are hollow, thinner, and more brittle than mammal bones, they tend to shatter and splinter when broken. For this reason, companion animals such as dogs should not be fed chicken bones, turkey bones, or other bird bones.

cartilage

tough, flexible connective tissue

of minerals, production of red blood cells, storage of chemical energy, and assistance with movement. The skeleton is the framework of the body; it supports the softer tissues and provides points of attachment for most skeletal muscles. The skeletal system also provides protection for many of the body's internal organs, reducing the risk of injury to them. For example, cranial bones protect the brain, vertebrae protect the spinal cord, and the ribs protect the lungs and heart.

Bone tissues store several minerals, including calcium (Ca) and phosphorus (P). When required, bone tissue releases minerals into the blood, facilitating the balance of minerals in the body. The red bone marrow inside some larger bones produces blood cells. It is also an important chemical energy reserve. The skeletal systems of mammals (class Mammalia) and poultry (class Aves) are shown in Figures 5-3 and 5-4. While the skeletal systems of these two classes are similar, there are many important differences. A major difference is the consistency of the bone material. The skeletal system of poultry is considerably less dense than the skeletal system of livestock. The light and hollow bones of poultry help them to have flying capabilities.

Formation of Bone **Cartilage** is a tough, flexible connective tissue. It forms the early skeletal structure of the vertebrate embryo. As the bones

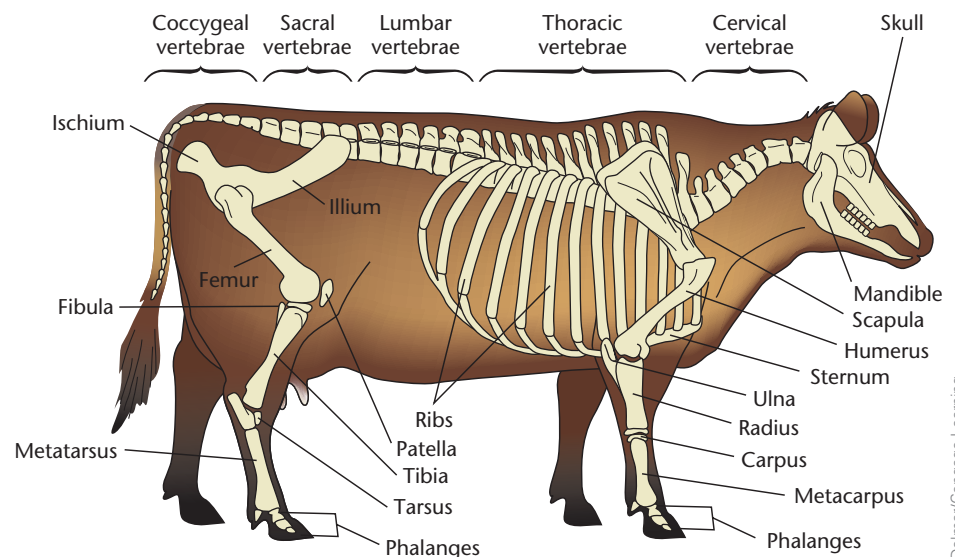
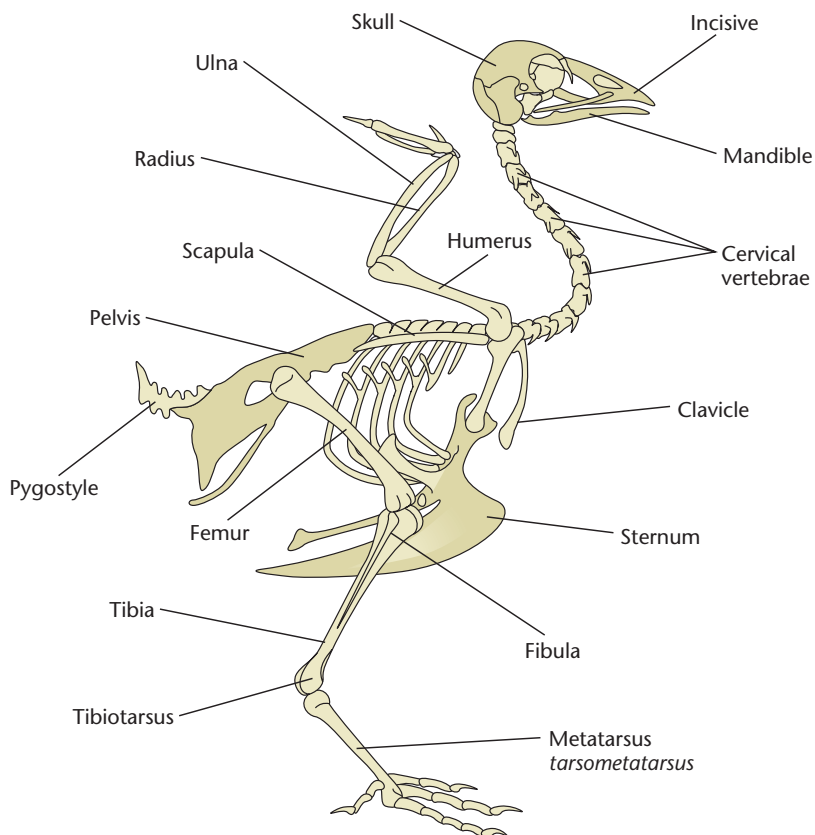


FIGURE 5-3

The skeletal system of a cow.



Delmar/Cengage Learning

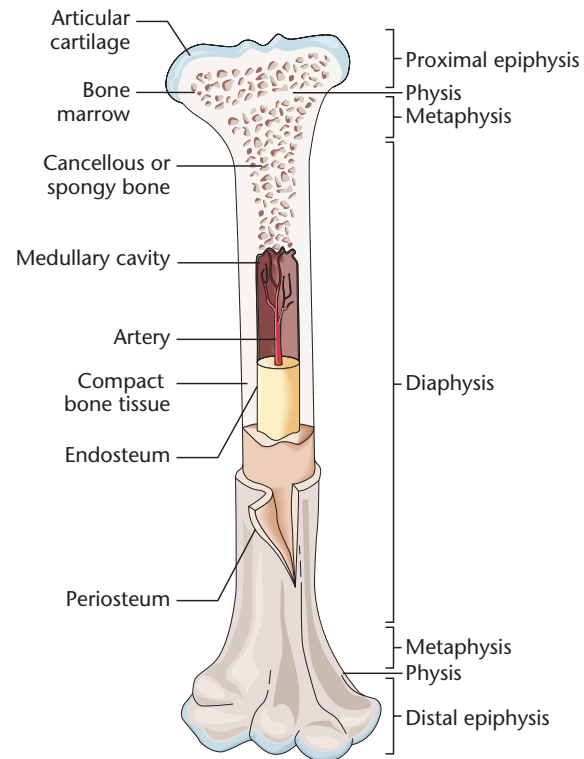
FIGURE 5-4

The skeletal system of a chicken. This illustration is typical of the skeletal system of birds.

develop, they follow the form of the cartilage and gradually replace much of the cartilage. Cartilage also connects muscles with bones, and makes up some other parts of the body such as the larynx and parts of the ears and nose.

Bone strength is reliant on proper nutrition. Bones are living tissues containing blood, lymph vessels, and nerve fibers. Without the proper diet, bones become weak and brittle and will cause a number of physiological problems. Weak bones and joints are directly related to a lack of calcium.

Kinds of Bones There are two kinds of bone material—cancellous (spongy) and cortical (compact)—that make up the structure of bones (Figure 5-5). Cancellous bone material is located beneath the compact bone, and consists of a meshwork of bony bars with many interconnecting spaces that contain bone marrow. Cortical bone material is composed of osteon and is usually found on the outside



Delmar/Cengage Learning

FIGURE 5-5

Section of a long bone.

osteon

the structural unit of bone that creates the hard, compact form of the bone

of bones, in concentric layers surrounding the bone marrow. **Osteon** is the structural unit of bone that creates the hard, compact form of bone.

Nervous System

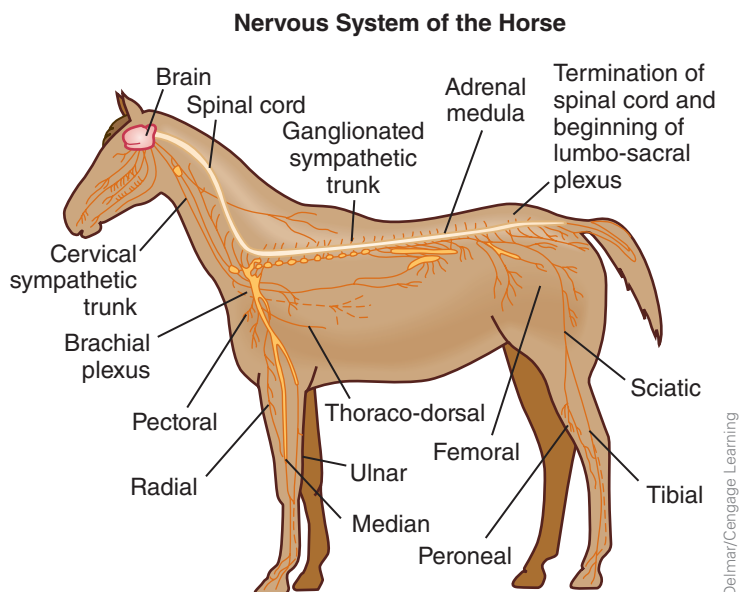
The nervous system transmits information to and from various parts of the body (Figure 5-6). The two major parts of the nervous system are the central nervous system and the peripheral nervous system.

The central nervous system is located in the skull and through the spinal column. It is the master control system for the entire body and consists of the brain and the spinal cord. The nerves that radiate from the central nervous system to all other parts of the body make up the peripheral nervous system. The sensory nerve fibers of the peripheral nervous system carry information to the central nervous system where it is analyzed, and appropriate responses are transmitted to the body.

The peripheral nervous system is separated into two types of control systems. The autonomic nervous

FIGURE 5-6

All animals, no matter the species, have the same basic structure of the nervous system.



Delmar/Cengage Learning

system controls involuntary movement, such as in digestion and the heartbeat of the animal. The somatic nervous system controls body organs or functions based on voluntary and conscious impulses by the animal. The skeletal muscle and five senses are controlled by the somatic nervous system.

Muscular System

A **muscle** is an organ that, with an impulse from the nervous system, is the primary method of movement (Figure 5-7). The three kinds of muscle tissue found

muscle

an organ that allows movement

FIGURE 5-7

The muscle system supplies the meat for human consumption.



Delmar/Cengage Learning

in the body are skeletal muscle, smooth muscle, and cardiac muscle. Each type is different in location, function, and structure. All three muscle types have the ability to contract, but they generally do not expand.

skeletal muscle

muscle that has dark bands that cross each muscle fiber; "meat" of farm animals; also called striated voluntary muscle

myoglobin

the pigmented (red) oxygen-transporting protein found in muscle

smooth muscle

unstriated muscle that surrounds the hollow, internal organs of the body; also known as smooth involuntary muscle

cardiac muscle

striated involuntary muscle found only in the muscular wall of the heart

Skeletal Muscle The skeletal muscle is mainly involved in movement. Skeletal muscles are controlled voluntarily by the somatic nervous system. The skeletal muscle is usually attached to the skeleton by tendons. Muscle that is involved with sustained work is generally red in color. This type of muscle has more **myoglobin**, which is the pigmented, oxygen-transporting protein of muscle. In poultry, the breast is termed white meat because it is a muscle that is seldom used by the animal, and therefore low in myoglobin. The thigh or drumstick of poultry is dark meat because farm poultry run more than they fly, making this type of muscle rich in myoglobin.

Smooth Muscle Muscles that surround the hollow, internal organs of the body, such as the blood vessels, stomach, intestines, and bladder, are called smooth or unstriated involuntary muscles. Smooth muscles, or involuntary muscles, are activated by the autonomic nervous system. Thus, they are not under the conscious control of the mind. The smooth muscle system is involved in digestion and other activities of the internal organs of the animal.

Cardiac Muscle Cardiac muscle is found only in the muscular wall of the heart. It is striated (striped) in the same manner as skeletal muscle, with dark and light bands. Cardiac muscles are involved in involuntary body functions, which means that the cardiac muscles contract without signals from the brain. Cardiac muscle cells are rectangular in shape, and the muscle fibers appear to branch. The cardiac muscle system maintains a rhythmic heartbeat that keeps the blood circulating throughout the body.

Circulatory System

The heart, arteries, capillaries, and veins make up the major parts of the circulatory system. The heart pumps blood throughout the body. In the capillaries, an exchange takes place between the blood and the body's cells. Nutrients and oxygen enter the cells from the blood. Carbon dioxide, water, and waste products enter into the blood from the cells. Once the nutrient-waste transfer is complete, the blood moves from the capillaries into veins, which eventually lead back to the heart.

Heart Blood is pumped through the circulatory system by the heart. This organ, in both mammals and birds, has four chambers. The left and right ventricles are found in the lower portion of the heart, and the left and right atria are found in the upper portion (Figure 5-8). Ventricles are the most muscular

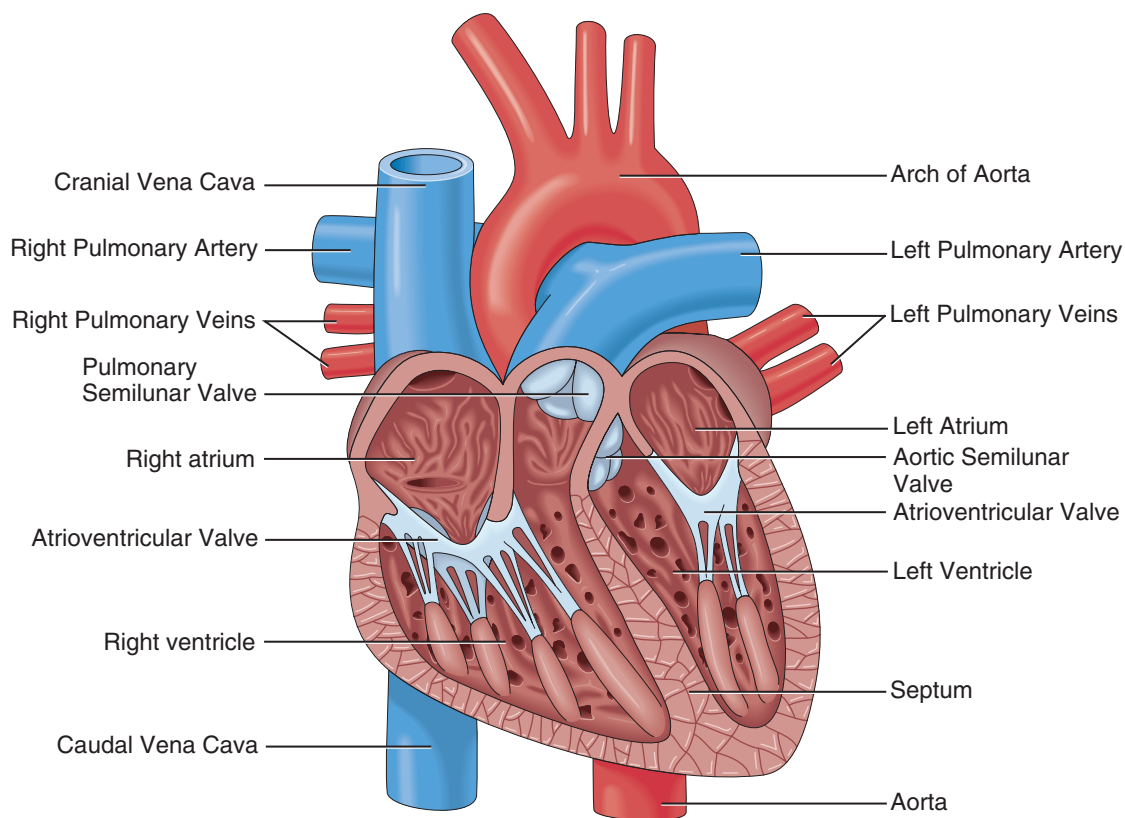


FIGURE 5-8

The parts of a heart. (Red sections represent oxygenated blood; blue sections represent deoxygenated blood.)

section of the heart because they push blood out of the heart, either to the lungs or the body.

artery

a blood vessel that carries blood away from the heart

vein

a blood vessel that carries blood to the heart

Blood Vessels **Arteries** are blood vessels that carry blood away from the heart. Blood carried by arteries is bright red, which means it is rich with oxygen. Blood which is dark red in color is deoxygenated blood because it is low in oxygen and high in carbon dioxide. The **veins** carry deoxygenated blood to the heart. The right atrium transfers deoxygenated blood into the right ventricle, which pumps it through the pulmonary artery to the lungs where oxygen is added, making it oxygenated blood (Figure 5-9).

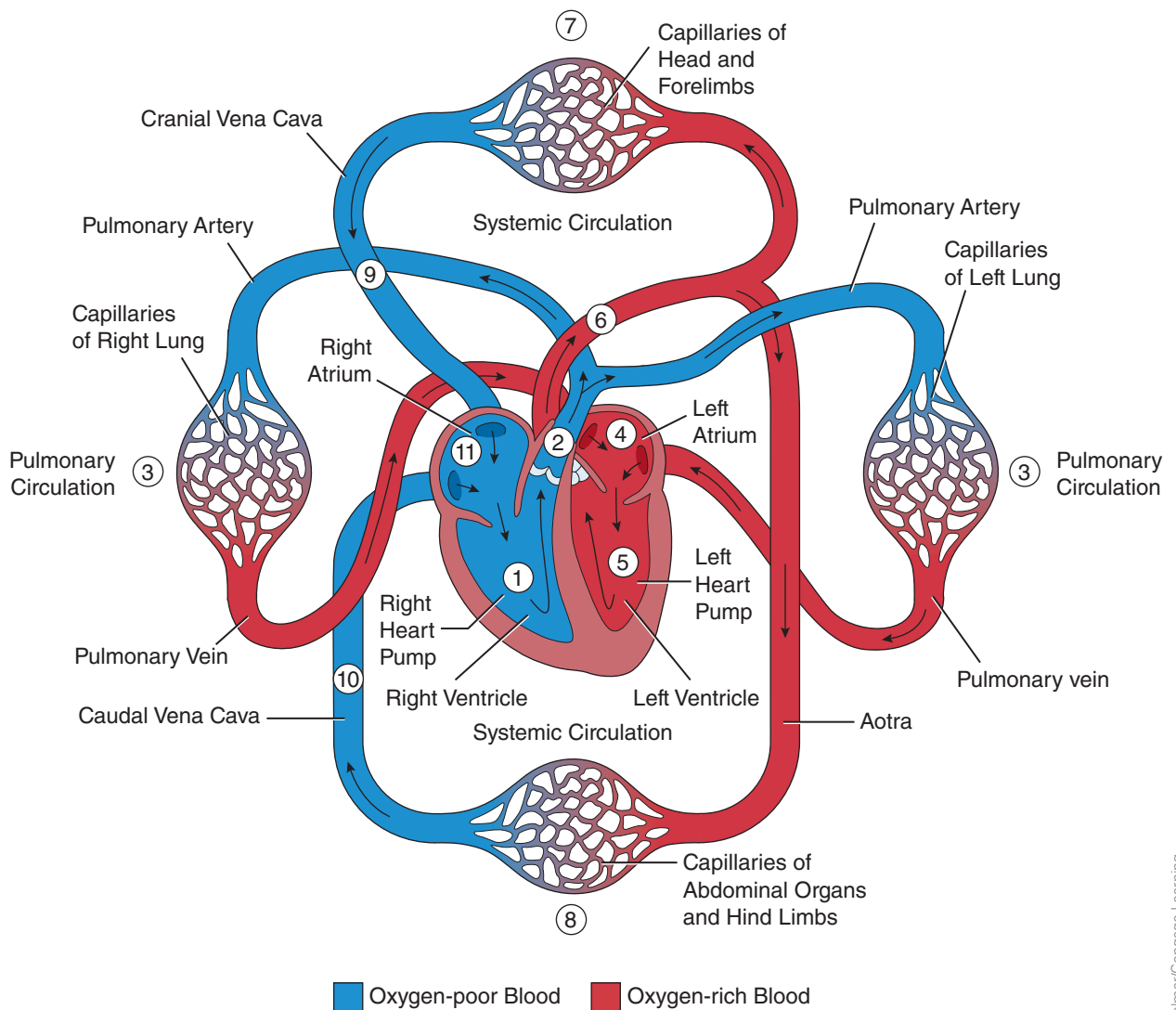


FIGURE 5-9

The circulatory system carries nutrients from food and oxygen that is dissolved in the blood to all of the cells of the body.

Pulmonary veins carry the oxygenated blood from the lungs back to the heart's left atrium. The blood then flows into the left ventricle and is carried by the aorta from the heart to the body.

Blood Blood serves a number of major functions in the body. It transports nutrients from the digestive system and oxygen from the lungs to body tissues. In addition, it transports carbon dioxide from the tissues to the lungs. Blood transports other waste products so they can be eliminated from the body. It helps regulate body temperature by transferring heat from the internal organs to the surface of the body. It also transports hormones as needed in the body. Maintaining the electrolyte balance and pH level in the body is also an important task of blood. The main function of **red blood cells** is to carry oxygen throughout the body. Red blood cells contain a protein called hemoglobin, which gives them their characteristic red color. The **hemoglobin** helps transport oxygen and carbon dioxide. Red blood cells are also responsible for removing carbon dioxide, a waste product, from the body. Red blood cells are constantly being replaced. Most red blood cells live only about 120 days.

White blood cells protect the body against disease and foreign materials. White blood cells are important for all animals to help maintain good health. They are not as numerous in the body as red blood cells. The body produces more white blood cells in response to infection. A high white blood cell count can be used to diagnose illness.

red blood cell

a cell that carries oxygen throughout the body and removes waste

hemoglobin

the red protein in red blood cells that helps transport oxygen and carbon dioxide

white blood cell

a cell that protects the body from disease and foreign materials

Integumentary System

The integumentary system is the organ system that protects the body from damage. This system includes the skin, hair, scales, feathers, and nails of animals. The integumentary system is the largest organ system of the body. Some of the most important

did you know?

Racehorses must have large nostrils to supply enough oxygen to the body while running at high speeds.

antigen

anything that stimulates an immune response

oxidation

a chemical process in which molecules give up energy in the form of electrons to bind with oxygen

respiration

a process in living organisms by which oxygen is brought into the body and carbon dioxide, along with water and other unneeded gases, are removed from the body

functions of the integumentary system include the following: defending the body against infectious organisms, protecting the body from dehydration, excreting waste materials through perspiration, and producing vitamin D through ultraviolet light exposure.

Immune System

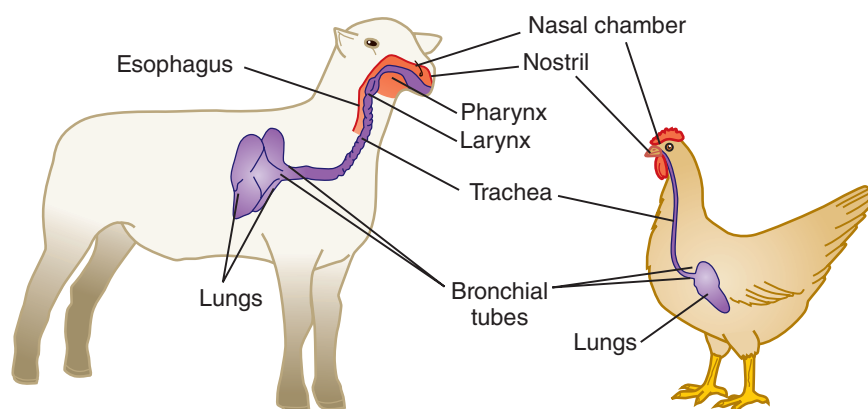
The immune system is a group of organs and cells that defend the body against infection and disease. A major component of the immune system is the lymphatic system. As a network of lymphatic vessels and lymph nodes, the lymphatic system transports fats, proteins, and lymphocytes. This fluid removes microorganisms and other debris from tissues while absorbing and transporting fats and fatty acids to the circulatory system.

Lymphocytes are a type of white blood cell that protects the body against **antigens**, generally viruses and bacteria. An antigen is anything that stimulates an immune response from the body. Organs within the lymphatic system include the bone marrow, lymph nodes, spleen, and thymus. The lymph nodes contain white blood cells in honeycomb-like structures. These nodes often enlarge when the body is infected due to an increase in the production of white blood cells.

Respiratory System

Animals use oxygen to release energy in their cells through the oxidation of carbon-containing molecules (Figure 5-10). **Oxidation** is a chemical process in which molecules give up energy in the form of electrons to bind with oxygen. A by-product of oxidation is the production of carbon dioxide. In its simplest form, **respiration** is the process by which oxygen is brought into the body and carbon dioxide is removed from the body. Water and other gases that the body does not need are also expelled during respiration.

Respiratory Systems of Domestic Animals



Delmar/Cengage Learning

FIGURE 5-10

The respiratory system of mammals and poultry are very much alike.

Digestive Systems

One of the most important systems for animal producers to understand is the digestive system (Figure 5-11). Knowledge of the digestive system is important in supplying the proper nutrition for growth and development. **Digestion** in animals is the process of breaking feed down into simple substances that can be absorbed into the bloodstream and supplied to cells throughout the body. The digestive system consists of the parts of the body involved in the breakdown and digestion of feed.

digestion

the breakdown of food into simple substances that fuel the body's cells



Science Connection

Animals, especially ruminants, produce a lot of methane gas, a potent greenhouse gas. Microorganisms in the digestive system produce methane as food is digested. The gas is expelled mostly in burps, but also through flatulence. The production of methane, especially by cows, has prompted many environmentalists to call for a 'gas tax' on farms producing livestock.

saliva

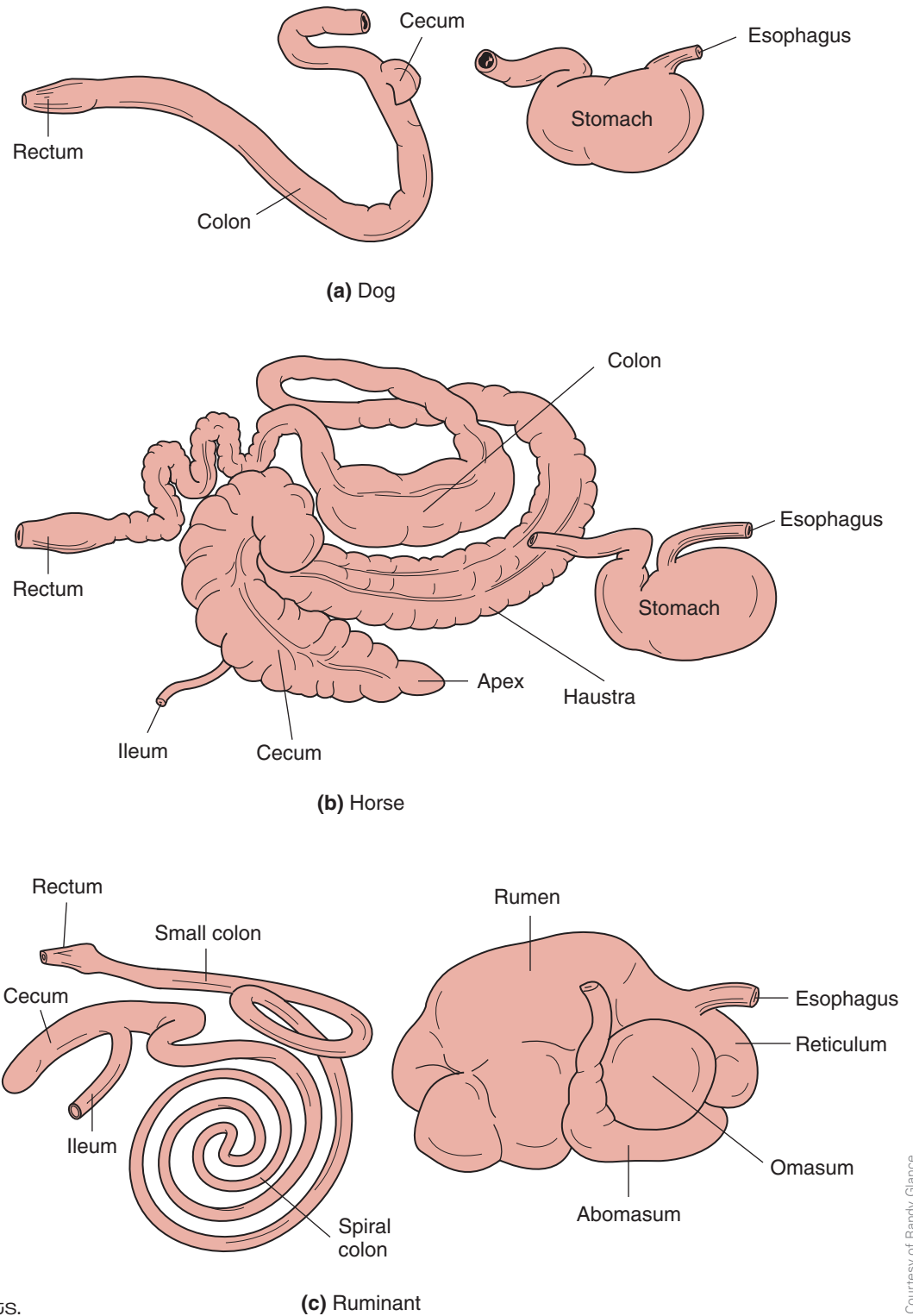
substance excreted by glands in the mouth to aid in digestion

enzyme

a substance that acts as a catalyst in a biochemical reaction; has the ability to speed up digestion

Mouth and Esophagus Digestion starts in the mouth. The teeth, tongue, and salivary glands are accessory organs located in the mouth, and begin to break down food by mechanical and chemical processes.

Saliva contains the chemical enzymes salivary amylase and salivary maltase. **Enzymes** are

**FIGURE 5-11**

Animal digestive tracts.

Courtesy of Randy Glance

substances that act as a catalyst to speed up the digestive process. Salivary amylase changes some starches to maltose or malt sugar. Salivary maltase changes maltose to glucose.

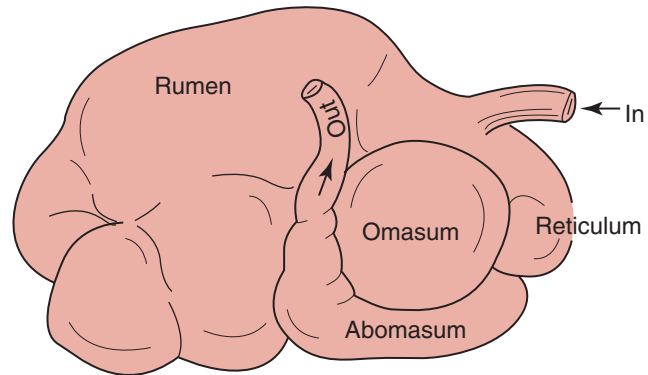
Stomach Animals are classified as ruminants or non-ruminants according to their stomach type. Ruminants have a stomach that is divided into several parts. Cattle, sheep, goats, deer, and llamas are all ruminants. Ruminants are cud-chewing animals. Non-ruminants, sometimes called monogastric animals, have simple, one-compartment stomachs. Pigs, humans, cats, and poultry are non-ruminants.

There is a great deal of difference among animals in their ability to use various kinds of feed. This is due mainly to differences in their digestive systems. Ruminant animals can digest large quantities of fiber-containing feeds, such as hay and pasture grasses. Cattle and sheep can digest about 44 percent of the roughage they eat. Roughage refers to high-fiber feeds, such as hay, silage, and pasture.

Horses are able to digest about 39 percent of the roughage in their food. Swine can digest only about 22 percent of the roughage they eat. Non-ruminant animals, like pigs and chickens, need high-energy, low-fiber food, such as grains. Grains and protein supplements are called concentrates. The most widely used concentrates are corn and soybeans. These make up the majority of feed for pigs and chickens.

Ruminants are able to digest large quantities of roughage because of the nature and function of their stomach and the microorganisms present in their digestive systems. These microorganisms can produce proteins, B-complex vitamins, and vitamin K. The kind of feed provided to ruminants affects the growth and health of microorganisms in the rumen. Since ruminant animals produce certain nutrients themselves, the job of balancing their diet is somewhat easier than it is for non-ruminants.

The Ruminant Stomach The ruminant stomach has four compartments: the rumen, the reticulum, the omasum, and the abomasum (Figure 5-12). Because of this four-part stomach, the digestive system of ruminants differs greatly from the digestive system of non-ruminants.



Courtesy of Randy Glance

FIGURE 5-12

The four-compartment stomach of a ruminant animal.

did you know?

The cud of a ruminant consists of partially digested roughages such as hay, silage, and coarse feeds like corn stalks. Other cud-chewing animals are sheep, deer, bison, water buffalo, and giraffes.

Ruminants eat rapidly. The partially chewed feed is swallowed and goes directly to the rumen. In the rumen, the feed is mixed and partially broken down by bacterial fermentation. When the rumen is full and the animal is at rest, the feed is forced back into the mouth and rumination occurs. During rumination, the regurgitated feed, or cud, is re-chewed to create smaller particles to make digestion easier. The cud is then re-swallowed. A cow makes an estimated 40,000 to 60,000 jaw movements per day as it chews and re-chews regurgitated food.

The rumen and the second stomach compartment, the smaller reticulum, make up 85 percent of the stomach. The rumen contains millions of microorganisms called bacteria and protozoa that break down the feed, allowing ruminants to digest roughages. These small organisms have several unique characteristics which allow ruminants to thrive on land and pasture in which it would be impossible for other animals to live.

Bacteria in the rumen break down low quality protein into amino acids. **Amino acids** are compounds that contain carbon, hydrogen, oxygen, and nitrogen. They are essential for growth and maintenance of animal cells. Amino acids are the building blocks of proteins. Bacteria also produce many of the vitamins needed by the animal.

The **omasum**, the third part of the ruminant stomach, grinds small amounts of feed with its muscular plates and absorbs fluid and nutrients.

amino acid

compounds containing carbon, hydrogen, oxygen, and nitrogen; the building blocks of proteins

omasum

the third part of the ruminant stomach that grinds small amounts of feed

abomasum

the true stomach in ruminants; the last stage in stomach digestion occurs here, where partially digested food mixes with gastric juices to complete digestion

The **abomasum** is called the true stomach of the ruminant because it is very similar to the stomach of humans and other monogastrics. In this fourth part of the ruminant stomach, partially digested feed is mixed with gastric juices to help complete digestion of the feed.

The Non-Ruminant Stomach Monogastric animals such as swine, dogs, cats, and humans have a single stomach, which primarily uses chemical processes to break down food. Mechanical processes in the stomach serve to mix feed with these chemicals. When feed enters the stomach of the non-ruminant or monogastric animal, gastric juice is secreted from glands in the wall of the stomach. The gastric juice contains strong hydrochloric acid (HCl).

**Science Connection**

A mnemonic or memory aid helps you remember a group of items. For the eleven body systems, use the mnemonic sentence “**In Reality Red Dairy Cows Never Eat Meat In Early Summer.” The first letter of each word represents the first letter of a body system.**

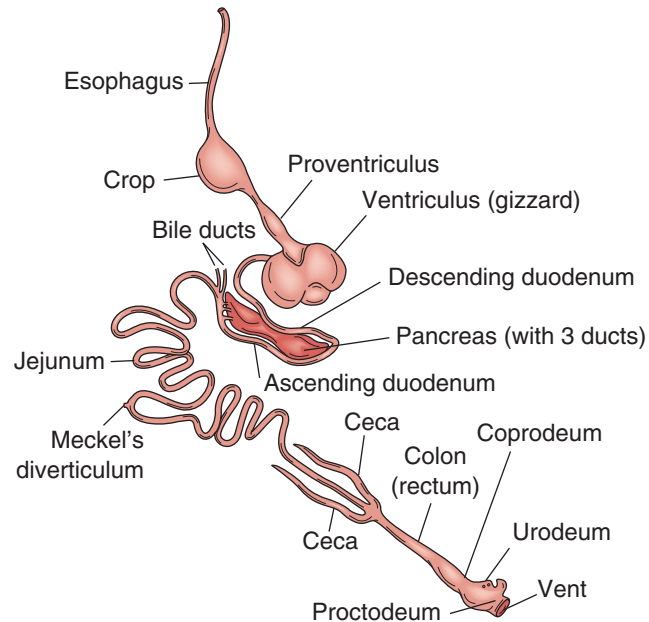
The gastric juice contains additional enzymes called pepsin, rennin, and gastric lipase. All enzymes break down food into smaller particles. Pepsin breaks the proteins in the feed into peptides and peptones. Any milk consumed is curdled by the rennin. Emulsified fats are split by the gastric lipase into glycerol and fatty acids. However, most of the fat entering the stomach is not emulsified, or broken down into small particles. This makes it hard for gastric lipase to digest the fat. Thus, gastric lipase can only break down small amounts of fat in the stomach.

The muscular walls of the stomach churn and squeeze the feed, mixing it with acids and enzymes. The liquid that results from this mixing, called chyme, is pushed into the small intestine for further digestion.

The Avian Stomach Birds are very different from ruminants and monogastric mammals. Birds,

FIGURE 5-13

The bird digestive system. The crop stores food and also helps grind the food with the help of muscles. The proventriculus contains enzymes that help to break down food particles even further before food reaches the gizzard. The gizzard grinds the food for better absorption.



Courtesy of Randy Glance

crop

a small pouch in the digestive system of birds attached to the esophagus that stores food

proventriculus

the true stomach in birds; produces enzymes that break down food

gizzard

a muscular organ in the digestive system of birds that grinds food for digestion

unlike mammals, have a crop and gizzard rather than teeth (Figure 5-13). The **crop** is a small pouch attached to the esophagus that stores food. This organ also softens food by grinding it with its muscles. The softened food continues to the two-part stomach of the bird. The **proventriculus** is considered the true stomach of birds. It is similar to the stomach of monogastrics, producing enzymes to break down food. From the proventriculus, the food moves to the **gizzard**. The gizzard is sometimes called the 'mechanical stomach' because this muscular organ grinds food for digestion. Birds instinctively swallow small rocks, which collect in the gizzard. With the aid of swallowed rocks, the gizzard grinds the food to a pulp that can then be readily absorbed in the intestines.

Small Intestine The small intestine is where most digestion takes place. During digestion in the small intestine, molecules of amino acids, fatty acids, and sugars are broken down from carbohydrates. Through the process of absorption, these molecules pass through the epithelial wall of the small intestine into the bloodstream. Undigested materials then travel to the large intestine.

Large Intestine In the large intestine, or colon, no digestion takes place, and very little absorption

takes place. The large intestine is mostly responsible for storage and removal of waste. Undigested material, including cellulose and plant fibers, is stored in the large intestine until it is expelled from the body through the anus.



Biology Connection

Although horses graze like cows, they are not ruminants. The large cecum and colon of the horse are the primary sites of fermentation and microbial digestion of roughages. The cecum contains a large population of microorganisms which break down feed into nutrients that can be absorbed in the cecum and colon.

Excretory System

The excretory system consists of four major components: the kidneys, ureters, bladder, and urethra (Figure 5-14). These components are responsible for filtering and excreting excess liquids from

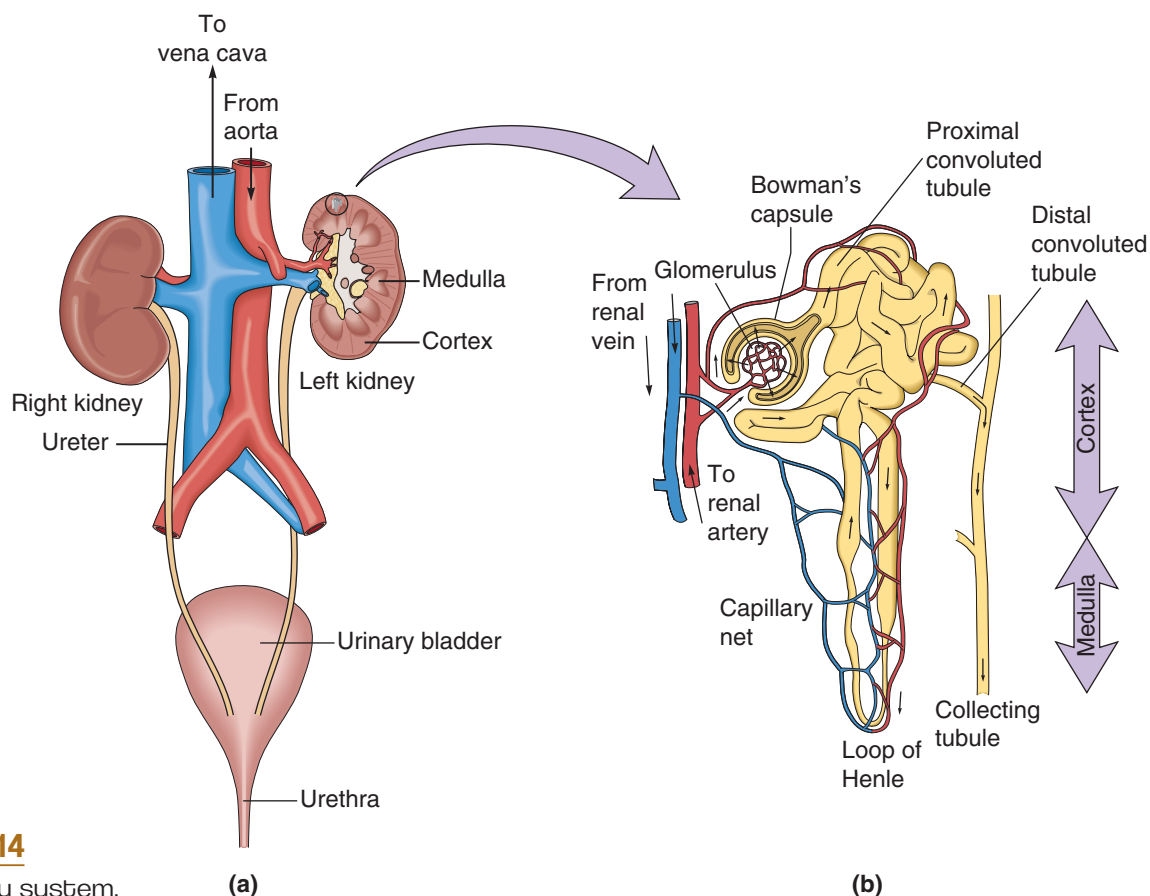


FIGURE 5-14

The excretory system.

did you know?

Many animals use urine to mark their territory. Other animals sense the odor and know that treading on marked territory could mean danger.

the body. In order to do this, blood passes through the kidneys where waste products and some water are filtered out. The liquid, now called urine, is then passed from each kidney through the ureter and into the bladder, which accumulates urine until it is full. Urine is then released from the body through the urethra.

Endocrine System

Hormones are chemical messengers which are sent through the bloodstream and trigger growth and development of cells elsewhere in the body. The endocrine system consists of a collection of glands which produce these hormones and distribute them to the rest of the body through the bloodstream (Figure 5-15). The pituitary gland, which is located at the base of the brain, is responsible for controlling the hormones that affect growth, metabolism, and reproduction. It directs the ovaries, testes, thyroid gland, and adrenal gland to produce hormones such as estrogen, testosterone, thyroid, and adrenaline, respectively. Another part of the endocrine

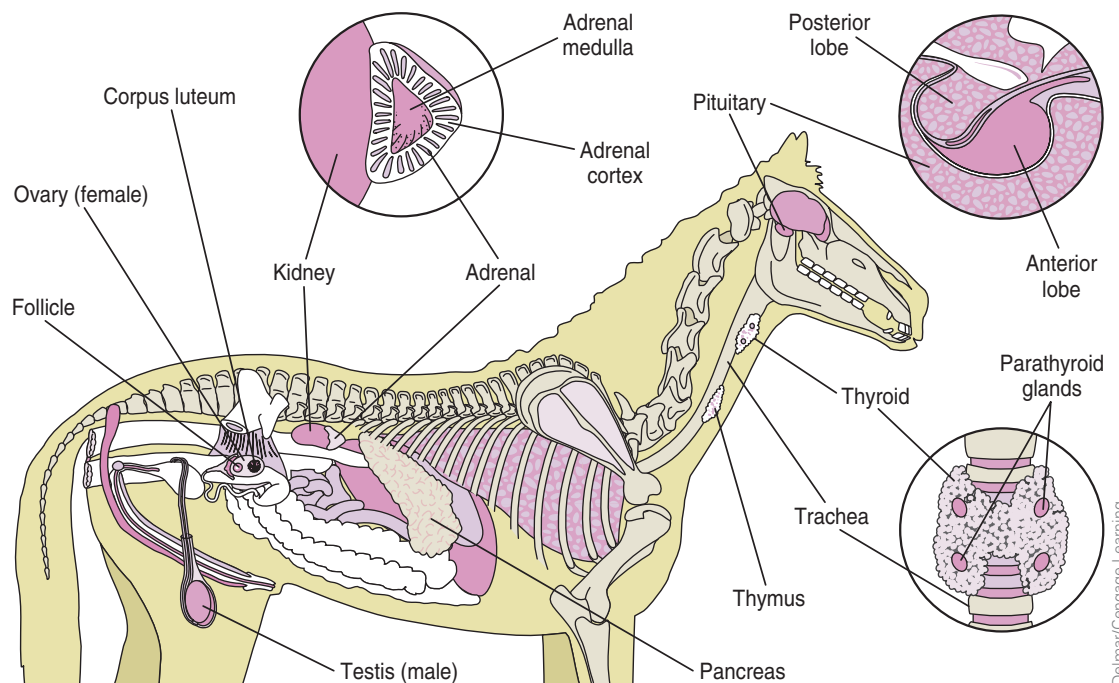


FIGURE 5-15

The endocrine organs of a horse.

did you know?

Birds do not produce urine and feces in the same way that mammals do. Their urine and feces are mixed together and expelled from the body at one time in a semisolid form. The mixture is called excreta. The white part of bird droppings is the urine portion of excreta.

system is the pancreas, which also produces very important hormones. The pancreas secretes insulin, which helps to control blood sugar and prevent diabetes.

Reproductive System

The reproductive system of animals is important to the survival of the species, and is the basis of economic animal production systems. Mammals have different reproduction systems than birds. Mammals carry their young in their womb, give birth to live young through a birth canal, and provide nourishment for the young. The mammalian reproductive system is more complex than that of egg-laying birds.

The terms used to describe birth (parturition), varies with the species of animal. Examples of parturition terminology:

- ▶ A dog whelps, which means that it gives birth to puppies.
- ▶ A cow calves, which means that it gives birth to a calf.
- ▶ A ewe lambs, which means that it gives birth to lambs.
- ▶ A goat kids, which means that it gives birth to kids.
- ▶ A horse foals, which means that it gives birth to a foal.
- ▶ A sow furrows, which means that it gives birth to piglets.

estrus cycle

the period of time that female animals can become pregnant

Estrus Cycle The **estrus cycle** or heat cycle is the period of time that female mammals can become pregnant. Most female mammals come into heat or season about every 21 days after maturity. This time

ovulation

the release of an egg from the ovary

ovary

organs that produce eggs in female animals

varies by species. During the estrus cycle, there are only two to three days when the females will accept the male for breeding.

Ovulation **Ovulation** is the release of an egg from the **ovary** (Figure 5-16). The ovaries produce the eggs for reproduction. This occurs in the two to three days when the female will breed with the male. If all the eggs released during ovulation are fertilized, then this is the number of offspring that the female will have at birth. However, not all the eggs released during ovulation may become fertilized.

Fertilization Fertilization takes place when the male deposits sperm into the female reproductive tract and a sperm cell penetrates the outer membrane of an egg. Sperm is produced in the testicles of the male animal (Figure 5-17). The sperm is carried from the testicles of the male through the penis during breeding. Millions of sperm are released into the female reproductive tract to help assure fertilization. Only one sperm cell can fertilize each egg.

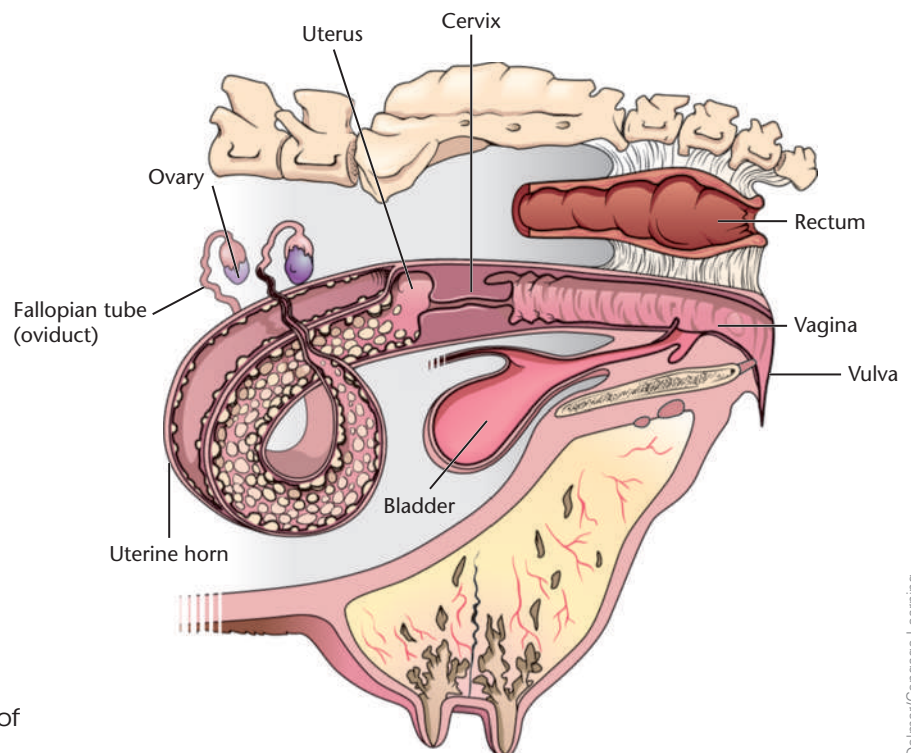
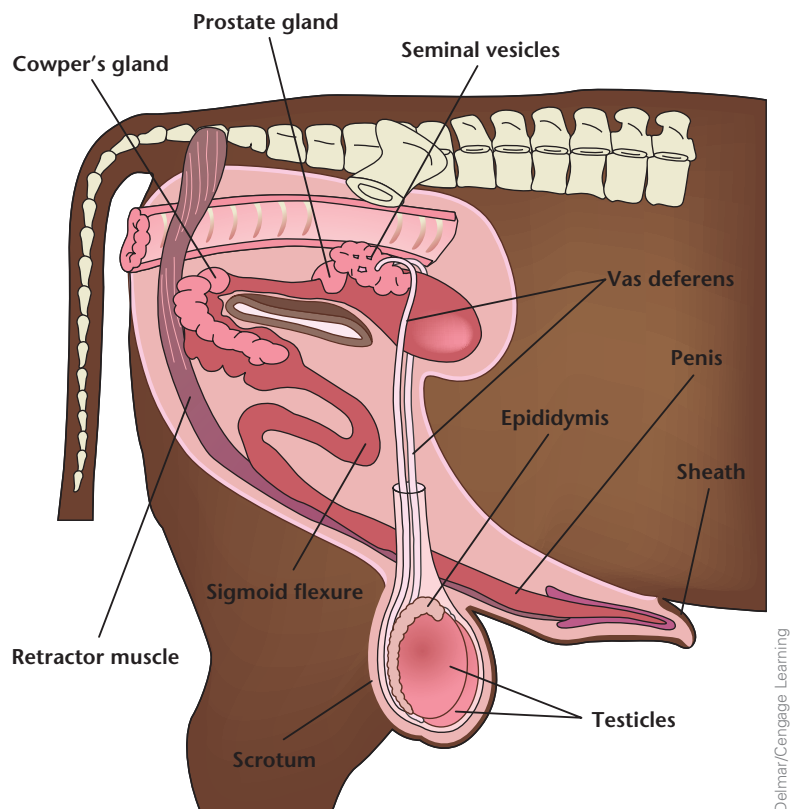


FIGURE 5-16

The female reproductive system of a cow, side view.



Delmar/Cengage Learning

FIGURE 5-17

Reproductive organs of a bull.

Once the egg has been fertilized, it develops a harder outer membrane that blocks penetration by another sperm cell.

Gestation Gestation is the time during which an animal is pregnant. It begins when an egg is fertilized. The fertilized egg is implanted into the uterus where the fetus develops. Gestation periods for mammals vary greatly. For example, the gestation period is 16 days for the hamster and 22 months for the elephant. During gestation, the fetus develops slowly and most of the growth occurs during the last third of the pregnancy. The fetus is contained inside the uterus, now called the womb, in a fluid filled membrane called the **placenta**. The umbilical cord connects the fetus to the mother. The fetus obtains its nutrition and oxygen through blood vessels in the umbilical cord. During the gestation period, especially during the last third portion, providing extra nutrition to the mother is very important for the fetus.

placenta

fluid filled membrane containing the fetus

A number of behavioral signs can indicate that an animal is about to give birth:

- ◀ **Isolation** – a female about to give birth may move away from the group.
- ◀ **Nesting behavior** – just before birth, females may build a bed/nest if there is material such as straw or grass that is available.
- ◀ **Off feed** – some animals will stop eating the day they give birth. Horses and goats are the exception.
- ◀ **Restlessness** – females may exhibit behavior indicating their discomfort, such as circling, pawing, biting at their flank, and groaning.

parturition

process of giving birth

Parturition **Parturition** is the process of giving birth. Close to the time of parturition, the mothers will usually become restless, may not eat, may make a nest, and will make noise. This signals the start of contractions. Contractions are when the mother's muscles start to push on the fetus, moving it into the birth canal and then expelling it from the mother's body. The first part that can be seen during birth is the fluid-filled membrane. Once this has burst, the fetus can be pushed out of the birth canal. Depending on the species, multiple births may take place. These multiple births should occur one after the other in brief intervals. When the mother is finished giving birth to all the young, she should expel the **afterbirth**. This afterbirth is the rest of the placenta and other membranes not expelled before the birth of the fetus.

afterbirth

the placenta and other membranes expelled after the birth of the fetus

Sometimes animals have problems giving birth. Two of the most common problems are that the fetus is too large for the birth canal, or the fetus is turned in the wrong direction and does not have its head facing toward the birth canal. Also, sometimes the mother may not be able to expel the afterbirth, in which case a knowledgeable person should help to remove it from the mother.

When the fetus is born, the umbilical cord breaks. At this time, the fetus must start to breathe. Should the fluid-filled membrane around the fetus not break, an attendant should break the membrane or the fetus will drown. If the mother has not given birth before or has had previous problems, an attendant should be available to help.

Summary

An animal's body is composed of a number of different kinds of tissues. Tissues are made up of cells. There are five main types of animal tissues: muscle, connective, nerve, epithelial, and fluid. The tissues of an animal's body are grouped together to form organs. An organ system is a group of organs that work together to carry out a particular task. The systems of an animal's body include the skeletal, muscular, respiratory, reproductive, integumentary, immune, circulatory, nervous, endocrine, excretory, and digestive system.

The skeletal system gives form, protection, support, and strength to the body. The skeleton is the framework of the body; it supports the softer tissues and provides points of attachment for most skeletal muscles. Avian bones tend to be smaller, thinner, and have more air space than mammalian bones.

The nervous system contains cells that transmit signals from one part of the body to another, as needed. The two major parts of the nervous system are the central nervous system and the peripheral nervous system. The peripheral system is subdivided into the autonomic nervous system, which controls involuntary actions, and the somatic nervous system, which controls voluntary actions. This system controls many of the other systems found in the body.

The muscular system helps the body move and performs other vital functions such as maintaining heartbeat. The three kinds of muscle tissues found in the body are skeletal, smooth, and cardiac.

The heart, arteries, capillaries, and veins make up the circulatory system. The heart pumps blood throughout the body. Blood carries oxygen and nutrients to the cells where they are needed, and removes waste products from those cells. The integumentary system is the organ system that protects the body from damage. This system includes the skin, hair, nails, feathers, and scales of animals. The immune system is a group of organs and cells that defend the body against infection and disease.

The respiratory system draws air into the body, where the oxygen is extracted to oxidize molecules that will provide energy for the body's activities. Air carrying waste products, such as carbon dioxide, are then expelled out of the body.

The digestive system consists of the parts of the body involved in the breakdown and digestion of feed. Ruminant animals can digest large amounts of roughage with the help of microorganisms in their four-part stomach. Non-ruminants must have more concentrates, such as protein, in their diet because they have a simple, one-part stomach. Most digested feed is absorbed from the small intestine of the animal. The large intestine stores and expels waste.

The excretory system consists of four major components: the kidneys, ureters, bladder, and urethra. This system filters the blood and carries liquid waste products out of the body. The endocrine system secretes hormones that are needed for growth and development of the body.

The reproductive system is perhaps the most important system to production animal agriculture. There are several functions that must happen to be successful in reproduction. These functions include the estrus cycle, ovulation, fertilization, gestation, and parturition.

Quick Facts

- The five types of animal tissue are muscle, connective, nerve, epithelial, and fluid.
- The main functions of the skeletal system are to provide form, protection, support, and strength for the body.
- The nervous system transmits information throughout the body. Its two major parts are the central nervous system and the peripheral nervous system.
- The autonomic nervous system is a part of the peripheral nervous system that automatically controls certain involuntary activities of the body, such as heartbeat.
- The somatic nervous system controls body organs or functions based on voluntary and conscious impulses by the animal.
- A muscle is an organ that is able to move because it receives an impulse from the nervous system.
- The three kinds of muscles found in the body are skeletal, smooth, and cardiac.
- Cardiac muscle is found only in the muscular wall of the heart
- Red blood cells carry oxygen throughout the body and remove waste.
- Red blood cells contain a protein called hemoglobin that gives them

their red color and helps transport oxygen and carbon dioxide.

- White blood cells protect the body against disease and foreign materials.
- Oxidation is a chemical process in which molecules give up energy in the form of electrons to bind with oxygen.
- Respiration is the exchange of gases that occurs mainly in the capillaries.
- Digestion in animals is the process of breaking feed down into simple substances that can be absorbed into the bloodstream and supplied to cells throughout the body.
- Saliva contains the chemical enzymes salivary amylase and salivary maltase.
- The ruminant stomach has four different compartments—the rumen, the reticulum, omasum, and abomasum.
- Bacteria, combined with the slow churning of the rumen contents and cud-chewing, help to break down feed in ruminants.
- The omasum, the third part of the ruminant stomach, grinds up small amounts of feed with its muscular

plates and absorbs fluid and nutrients.

- The abomasum, the fourth part of the ruminant stomach, is called the true stomach of the ruminant because it is most like the stomach of humans and other monogastrics. It uses chemical processes to digest food.
- Non-ruminants, or monogastric animals, have simple, one-compartment stomachs.
- The avian digestive system consists of the crop, proventriculus, and gizzard.
- Most absorption of nutrients occurs in the small intestine.
- The large intestine stores and expels waste.
- The excretory system consists of four major components: the kidneys, ureters, bladder, and urethra. This system filters the blood and carries liquid waste products out of the body.
- The endocrine system secretes hormones that are needed for growth and development of the body.
- The estrus cycle, ovulation, fertilization, gestation, and parturition are all functions of the female reproduction system.

Student Learning Activities

1. Prepare an oral report with a visual aid about one of the major body systems found in animals. Identify the parts of this system and explain their function.
2. Prepare a bulletin board display with pictures of various species classified as ruminant and non-ruminant animals. Using pictures or samples of feeds, show typical feeds that are given to each kind of animal.
3. With an understanding of animal body systems, plan and conduct a supervised agricultural experience program in order to more effectively feed and manage animals.
4. Have a veterinarian talk to the class about organ systems and their importance.
5. Obtain organs from a harvesting facility for examination.

Discussion Questions

1. Describe the kinds of bones normally found in the mammalian skeletal system.
2. Name five functions of bones.
3. What are the major parts of the nervous system, and what are their functions?
4. Compare and contrast the three types of muscle found in the animal body.
5. What are the major components of the circulatory system, and how do they function?

Review Questions

True/False

1. The kind of food that is fed affects the growth of microorganisms in the rumen.
2. Non-ruminants do not require high levels of grain and can survive on roughage alone.
3. Functions of the skeletal system include protection, support, and body movement.
4. Ruminants include pigs, birds, dogs, and humans.
5. The pituitary gland in the brain secretes hormones and is part of the endocrine system.

Multiple Choice

1. Feed eaten by poultry goes to the _____ where it is stored and softened by saliva and other secretions from the walls of this organ.
 - a. crop
 - b. gizzard
 - c. esophagus
 - d. stomach
2. The study of how living organisms function, including such processes as nutrition, movement, and reproduction is:
 - a. anatomy
 - b. ontology
 - c. physiology
 - d. methodology
3. Which of the following is not a part of the skeletal system?
 - a. bones
 - b. esophagus
 - c. cartilage
 - d. teeth
4. Which of the following is not a type of muscle?
 - a. skeletal
 - b. smooth
 - c. epithelial
 - d. cardiac
5. Most absorption of nutrients into the bloodstream occurs in the _____.
 - a. small intestine
 - b. large intestine
 - c. esophagus
 - d. stomach

Completion

1. _____ are a group of animals that can digest large quantities of roughage in their digestive systems.
2. The _____ is called the true stomach of a ruminant.
3. _____ refers to high fiber feeds such as hay, silage, and pastures.

4. Red blood cells contain a protein called _____ which gives them their red color.
5. The _____ controls body organs or functions based on voluntary and conscious impulse by the animal.

Short Answer

1. What is the purpose of “chewing cud?”
2. What function do bacteria and other microorganisms serve in the rumen?
3. List the four parts of the ruminant stomach.
4. Describe the typical avian digestive system.
5. What is the function of the immune system?



CHAPTER 6

Animal Nutrition and Feeding

OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Classify animal digestive systems based on diet.
- Describe the classes of nutrients needed by animals.
- Explain the classes of additives sometimes used in feed.
- Describe the ingredients commonly used in animal feeds.
- Differentiate between roughage and concentrated feedstuffs.

KEY TERMS

carnivore	lipid	concentrate
omnivore	deficiency	ration
herbivore	feed additive	diet
nutrient	withdrawal	palatable
feedstuff	period	marbling
protein	hormone implant	fetus
amino acid	probiotic	feed tag
carbohydrate	roughage	medicated feed

LANGUAGE CONNECTION

English	French	Spanish	German	Italian
Nutrition	Nutrition	La Nutrición	Ernährung	Nutrizione
Diet	Régime	La Dieta	Diät	Dieta
Nutrient	Aliment	El Alimento	Nährstoff	Sostanza Nutriente
Ration	Ration	La Ración	Zuteilung	Razione

Differences in Animal Nutrition

Animal species vary in nutritional needs and the types of foods they consume (Figure 6-1). Their nutritional needs are determined by the kind of stomach they have, and what kind of food they can digest. There are two stomach types in livestock animals: ruminant and non-ruminant stomachs. These two types of digestive systems were discussed fully in Chapter 5. Animals are further divided into what they are able to digest.

Carnivores are animals that eat meat or meat products. Dogs and cats are carnivores. **Omnivores** are animals that eat a combination of meat products and plant products. Humans, swine, and poultry are omnivores. **Herbivores** are animals that eat

carnivore

an animal that eats meat and meat products

omnivore

an animal that eats a combination of meat and plant materials

herbivore

an animal that eats plant materials

FIGURE 6-1

Roughages include grass, hay, and silage. Shown is a typical ration for dairy cows.



plant material as their primary source of nutrition. Herbivores generally include livestock such as cattle, sheep, goats, and horses.

Analyzing Dog Food

Ingredients in dog food are listed on dog food labels by quantity, with the ingredient present in the largest amount listed first. Many lower-quality, inexpensive brands of dog food list corn as the first ingredient. Large amounts of corn are not harmful to dogs, but corn is not easily digested and does not provide an adequate amount of protein. For carnivores, such as a dog, protein is the most important dietary component. High-quality, protein-rich dog foods have a meat source, such as chicken or beef, listed as the first ingredient on the label.

nutrient

chemical elements or compounds found in food that provide energy, promote growth, and allow for the maintenance of body functions

Nutrients and Sources

Proper nutrition is important to the well-being of animals. A balanced diet is necessary for proper growth and normal body functions of an animal. **Nutrients** are chemical elements or compounds that promote growth, provide energy, and allow the animal to maintain body function. Nutrients are absorbed from the digestive tract and metabolized by the body.

Animals differ in the kinds and amounts of nutrients they need. Nutrient requirements vary depending on age, activity level, breed, sex, environmental conditions, initial body condition, and reproductive stage. For example, a lactating cow will need a higher level of nutrition than a non-lactating cow. Animals' nutrient levels change throughout their lifetime. Lacking one or more nutrients will affect the health of the animal, slowing growth, causing disease, raising feed costs, and even causing death in extreme cases (Figure 6-2).

FIGURE 6-2

Animals not receiving enough nutrition or an improper balance of nutrients become stressed and may succumb to disease.



Courtesy of USDA

There are six basic nutrients needed by animals: protein, carbohydrates, fats (lipids), vitamins, minerals, and water. Fats, carbohydrates, and water are made of carbon, hydrogen, and oxygen molecules in varying configurations. Proteins contain nitrogen in addition to these elements.

These nutrients are delivered to the animals through different types of feedstuffs. **Feedstuffs** are the ingredients in animal diets, including the non-nutrient components such as flavoring or preservatives (Figure 6-3). Feedstuffs are combined to create feed with the correct balance of the six basic nutrient classes. If only one feedstuff were given, the complete nutritional needs of the animal would not be met.

feedstuff

ingredients in the diets of animals,
including flavoring and preservatives

**FIGURE 6-3**

Common feedstuffs include:
(top left to right) citrus pulp, whole
cottonseed, soybean hulls (ground),
corn meal, distillers grain, and
soybean meal.

Delmar/Cengage Learning

Animal feeds are divided into two categories: roughages and concentrates. Roughages are high in fiber and are less digestible than concentrates. Roughages include hays, grasses, silage, and straw. Concentrates are high in energy content and are easily digestible. A few concentrates are wheat, soybean meal, oats, molasses, and dried milk products.

Proteins

protein

an organic compound composed of amino acids that are used in the building and repair of tissues

amino acid

an organic compound that is a building block of proteins

Proteins are organic compounds composed of **amino acids**. Amino acids are the building blocks of proteins. Proteins supply material to build and repair body tissues. The ligaments, hair, hooves, horns, skin, internal organs, and muscles of the animal body are partially formed from the amino acids in proteins. Protein is essential in weight gain, growth, and gestation. Some examples of a protein feedstuff are soybean meal, cottonseed meal, and sunflower seeds or other oil seed crops (Figure 6-4).

carbohydrate

an organic substance occurring in foods; there are four types: sugars, starches, cellulose, and lignin, all of which can be broken down by animals for energy

Carbohydrates

Carbohydrates should provide most of the energy requirements for livestock. They account for about 75 percent of livestock diets. There are four types of carbohydrates: sugars, starches, cellulose, and lignin.

FIGURE 6-4

Oil seed crops, such as sunflowers, are used in animal feeds.



Simple carbohydrates are easily digested and include sugars and starches. Complex carbohydrates include cellulose and lignin, and are often referred to as fiber, which is found mainly in animal roughages.

Energy from carbohydrates powers muscular movement such as heartbeat, breathing, and digestive contractions. Carbohydrates are also used to produce body heat that helps keep the animal warm. Excess carbohydrates in animals are converted to fat and then stored in the body. Corn and soybeans are the two most common choices for adding carbohydrates to the livestock diet (Figure 6-5). Other carbohydrates fed to livestock include wheat, rice, other grains, and some root crops.



Courtesy of USDA, Scott Bauer

FIGURE 6-5

Soybeans are one of the most common ingredients in animal feeds.

lipid

fats and oils

Fats (Lipids)

Fats and oils, also known as **lipids**, are often misunderstood because they are considered to be the cause of obesity. It is true that a food high in fat will cause obesity in an animal that has a low expenditure of energy. Therefore, it is important that animals are not overfed. Fats are important for good health. They help maintain the health of the skin and nervous system. The energy value of lipids is higher than that of carbohydrates. In fact, lipids have 2.25 times the energy value of carbohydrates.



Science Connection

There are two types of fats that are important in human nutrition. Saturated fats are found in animal and dairy products. Saturated fats are often solid at room temperature, such as butter, lard, and cream. Unsaturated fats can help lower the amounts of bad cholesterol in humans. Unsaturated fats are liquid at room temperature. They are usually found in foods such as whole grains, sunflower oil, peanuts, and olive oil. Unsaturated fats are healthy when consumed in small amounts. Both saturated and unsaturated fats are necessary for good health.

Vitamins and Minerals

Vitamins (organic) and minerals (inorganic) are necessary for proper absorption of fats and carbohydrates, and for chemical reactions in the body (Figure 6-6). Animals need these nutrients in the proper amounts for optimum health.

Vitamins are divided into fat-soluble and water-soluble types. Water-soluble vitamins cannot be stored and are excreted from the body if they are not used; fat-soluble vitamins are stored in fatty tissue. The fat-soluble vitamins are A, D, E, and K. Fat-soluble means that fat molecules are required to dissolve the vitamins for use. Water-soluble vitamins are able to be dissolved by water. These include vitamins B and C. A **deficiency** is a lack of a certain vitamin or mineral in an animal's system.

deficiency

lack of a nutrient in an animal's system

FIGURE 6-6

A good vitamin and mineral mix is imperative for livestock health.



Courtesy of Christy Bryan

Minerals are inorganic substances needed for good health, and are found in small amounts in an animal's body. Minerals are classified as macrominerals or microminerals. Macrominerals, such as calcium and potassium, are needed in relatively large amounts. Microminerals, or trace minerals, such as iodine and iron, are needed in smaller amounts.



Science Connection

Vitamin B₁₂ is the only B vitamin that cannot be obtained from fruits or vegetables. B₁₂ is supplied only through animal products such as meat, dairy products, and eggs. It is very important for people who do not eat enough meat or other animal products to take B₁₂ supplements or to eat foods that have been fortified with B₁₂.

Water

All living organisms require water to live. Fresh, clean water should be available at all times (Figure 6-7). Water makes up about 65 percent of an animal's body. Water regulates body temperature and is vital for organ functions such as digestion, waste removal, and the absorption of nutrients. An animal can live longer without food than without water.



©Stockphoto/Mary Morgan

FIGURE 6-7

A fresh and clean supply of water is required for all animals.

feed additive

a substance added to animal feed to promote growth and health

Feed Additives

Animals require carbohydrates, lipids, proteins, vitamins, minerals, and water to grow and produce efficiently. In addition to nutrients, animal feed often contains additives. **Feed additives** are ingredients added to animal feed to improve growth and health. If used, additives are added in small quantities. They are not considered nutrients, but perform a valuable function for the animal. The kinds of additives used include antimicrobial compounds (such as antibiotics), hormones and hormone-like substances, anthelmintics (dewormers), buffering agents, feed flavors, and bloat preventatives.

Antimicrobial Drugs

Antimicrobial drugs, which include antibiotics, are feed additives sometimes used in livestock and poultry food. These compounds are beneficial because they kill or slow the growth of harmful microorganisms in animals.

Feed supplements with antibiotics in them must be taken away from the animal for a period of time, called a **withdrawal period**, before the animal is sent to market or used to produce milk. This practice is required by law.

withdrawal period

the time an animal must be taken off of any antibiotics before the animal is sent to market or used to produce milk

Hormones and Hormone-Like Compounds

Hormones are substances naturally occurring in the animal's body. Hormones regulate body functions, such as growth, metabolism, and the reproductive cycle. The glands in the animal's body secrete natural hormones into the body fluids. Some of the sex hormones are added to food to improve feed efficiency and increase the rate of growth. These hormones increase the rate of protein synthesis and muscle development. Hormones may be administered as a feed additive or as a **hormone implant**. Beef cattle have shown better response to the use of hormones than other livestock. Hormone implants are routinely used in finishing cattle.

hormone implant

a device placed under the skin of an animal that delivers hormones to the animal



Legal Connection

The use of growth hormones and other feed additives in animal agriculture is strictly regulated by the Food and Drug Administration (FDA) and the United States Department of Agriculture (USDA). Growth hormones are approved for use in beef production and are illegal to use in poultry production.

Anthelmintics (Dewormers)

Parasitic worms of animals include large roundworms, nodular worms, and whipworms. To control worms, anthelmintics (dewormers) may be given to the animal in either feed or water, or applied to the coat of the animal, usually along the back (Figure 6-8). Eliminating worms is very important. Worms reduce feed efficiency, rate of gain and compromise the general health of the animal.

Other Feed Additives

probiotic

beneficial microorganisms added to feed to improve digestion

Probiotics are beneficial microorganisms such as yeasts and bacteria that are added to the feed to improve digestion. The use of probiotics has been

FIGURE 6-8

There are several methods that producers can use to deworm their animals. These methods include topical (as shown), by mouth, or by injection.



Delmar/Cengage Learning

shown to improve animal performance by increasing the number of beneficial microbes in the digestive system.

Health Concerns

There has been a growing concern that the use of antibiotics in animal agriculture may have an adverse effect on human and animal health. This concern centers on constantly feeding antibiotics at low levels to ward off disease. It is feared that this continuous low-level use of antibiotics might result in the development of antibiotic-resistant strains of microorganisms that would be hard to control. Bacterial resistance to drugs has been observed after animal and human use. There have been numerous studies dedicated to the research of this subject, and several laws and regulations have been proposed. Debate on the use of antibiotics in animal production continues, and legislation and regulations regarding antibiotic use are likely to change in the future.

Classification of Feeds

roughage

feed that is high in fiber (more than 18 percent crude fiber)

Animals rely on an assortment of feeds that have unique characteristics (Figure 6-9). Two types of feed are roughages and concentrates. **Roughages** are a

FIGURE 6-9

Commercial feed producers often mix vitamins and minerals into their feeds. This makes a “complete” feed.



©Stockphoto/Kersein Klaassen

concentrate

feed that is high in energy with less than 18 percent crude fiber

type of feed that contain a large portion of fiber. Feed can be classified as roughage if the feed contains more than 18 percent crude fiber. Roughages include hay, silage, grasses and fodder. **Concentrates** are feeds, such as corn and other grains, that are high in energy with less than 18 percent crude fiber. There are two classes of concentrates: protein supplements and energy feeds.

It is necessary to balance the intake of roughages and concentrates for the particular species and age of the animal being fed. Ruminants can use more roughages in their diets than non-ruminants. Also, younger animals are not able to digest as much roughages as more mature animals. The purpose for which the animal is being fed must also be considered when including roughage in the diet. For example, if the goal is to fatten animals for the market, they generally should be fed less roughages and more concentrates than breeding animals.

Protein supplements are livestock feedstuffs that contain 20 percent or more protein. They are divided into two groups based on their source – those that come from animals or animal by-products, and those that come from plants. Many vegetable protein sources contain around 45 percent crude protein. Common vegetable protein sources are soybean

meal, cottonseed meal, linseed oil meal, peanut oil meal, corn gluten feed, brewer's dried grains, and dried distiller's grains.

Animal feeds with less than 20 percent crude protein are called energy feeds. Some common energy feeds are corn, sorghum grain, oats, barley, rye, wheat, wheat bran, citrus pulp, beet pulp, and whey. Corn is, by far, the most widely used energy feed.

Ration Characteristics

Feed is the major cost in animal production. Feed costs may account for 75 percent or more of the total cost of raising livestock, depending on the livestock enterprise. It is important to develop rations that are as economical as possible to help ensure profits.

A **ration** is the total amount of feed given to an animal in a 24-hour period. A balanced ration is one that has all the nutritional material the animal requires in the correct proportions. The term **diet** refers to the type and amount of feed provided over a period of time.

Along with being nutritional, the livestock feed must also be **palatable** for the animal. Palatability refers to an appetizing or pleasing taste. If the feed is not palatable, the animal may refuse to eat the feed (Figure 6-10).

ration

the total amount of feed provided to an animal in a 24-hour period

diet

the type and amount of feed provided over a period of time

palatable

pleasing to the taste



FIGURE 6-10

Feed rations should not only be nutritious, but also be pleasing to the taste (palatable) for livestock.

There are two ways in which feed can be provided to animals: free access and scheduled feeding. Free access, also known as free choice, allows the animals access to feed at all times. Scheduled feeding is providing feed at certain times of the day. Breeding animals, pets, and pleasure animals such as horses are most often on scheduled feeding to prevent over-eating. Animals being raised for harvest, dairy animals, and egg-layers are most often fed free choice.

Ration Functions

Several factors should be considered when determining the type and amount of feed to provide animals. These factors are maintenance, growth, fattening, production, reproduction, and work.

Maintenance

A maintenance ration provides nutrients that are necessary for maintaining the life of the animal. This is the minimal feed necessary to carry out basic body functions and maintain weight. An animal on a maintenance ration will not have any energy to expend on other activities, such as growth and performance.

Growth

After the maintenance requirements of the animal are met, the nutrients in the ration are used for growth. Animals grow by increasing the size of their muscles, bones, organs, and connective tissues.

Fattening

Feed nutrients that are not used for either maintenance or growth may be used for fattening. The process of storing fat within the muscles is called **marbling**, because the streaks of white fat in red meat resemble the coloring of marble. Marbling helps make meat juicy and tasty. Fat on animals ready for harvest is called finish.

marbling

fat intermingled with the muscle fibers

Production

The nutrients required for animal production depend on the type of animal that is being produced. For example, cows, swine, horses, sheep, and goats produce milk to feed their young. Dairy goats and cows also produce milk for human use. Chickens produce eggs. Sheep and goats produce wool and mohair. The kind of nutrients needed depends on the type of production.

Reproduction

The ration must include proper nutrition during reproductive phases. Without the correct amount of nutrients, animals may not become pregnant, may abort, or the offspring may be unhealthy. Nutrients are essential to maintain the mother's body and to assure proper development of the fetus. The **fetus** is the unborn animal, that is still developing in the mother's womb.

fetus

unborn animal, that is still developing in the mother's womb

Work

It is important to consider the type of work an animal does when formulating a ration. For example, horses perform work when they are ridden because they expend energy. The energy needed for work comes from carbohydrates, fats, and extra protein in the ration. The animal usually converts fat stored in the body to energy when there are not enough nutrients in the ration.

Feed Tags

feed tag

label attached to a bag of commercial feed

A **feed tag** is the label attached to a bag of commercially prepared feed (Figure 6-11). Owners who purchase prepared feeds rely on the company to provide a balanced, quality ration. However, understanding how to read the feed tag can help to provide the correct diet for the animal.

FIGURE 6-11

Feed tags should list ingredients, and a guaranteed analysis. Also, tags should inform customers if the feed is medicated.

Heifer Ration	
Net Weight 50 lbs	Lot # ~JU
Guaranteed Analysis	Batch # MTIME
Crude Protein	11 % (min)
Crude Fat	3% (min)
Crude Fiber	15 % (max)
Ingredients: Grain Products, Processed Grain By-Products, Plant Protein Products, Roughage Products, Cane Molasses, Calcium Carbonate, Salt, Dicalcium Phosphate, Copper Sulfate, Ferrous Carbonate, Ferrous Sulfate, Manganous Oxide, Zinc Oxide, Cobalt Carbonate, Calcium Iodate, Sodium Selenite, Vitamin A Supplement, Vitamin D 3 Supplement, Vitamin E Supplement and Mineral Oil.	
Warning: DO NOT feed any product that is moldy, rodent or insect infested, or abnormal in appearance or odor to animals as it may cause illness or death.	
Manufactured By: Godfrey's Warehouse, Inc. P.O. Box 488 Madison, GA 30650	

Courtesy of Innisfail Farms

A feed tag lists the amounts of vitamins and minerals, plus percentages of protein, fat, and fiber. It will provide, in general terms, what ingredients are mixed together to create those percentages.

If the feed is medicated, the word “medicated” must appear under the name of the feed. The FDA requires all manufacturers of medicated feeds to provide information on the label about the proper use of the feed. Any feed that contains one or more medications, such as an antibiotic, is defined as a **medicated feed**.

medicated feed

any feed that contains one or more medications

Summary

Animals vary in their nutritional needs based on many factors, including age, breed, sex, disease, purpose, and environment. Animals are classified as carnivores, omnivores, or herbivores based on their diets. There are two stomach types that influence the type of nutrition an animal needs: ruminant and non-ruminant (or monogastric). Ruminant animals have a four-compartment stomach and can utilize a wider variety of roughage and feedstuffs than non-ruminants. Non-ruminant animals have only one stomach compartment and have a more limited diet, one usually high in concentrates such as corn.

Nutrients are the compounds and elements found in feed that provide the animal with the nutrition it needs to be healthy and produce. There are six basic nutrients needed by animals: proteins, carbohydrates, fats (lipids), vitamins, minerals, and water. These nutrients are delivered to the animals through different types of feedstuffs. Feed is typically divided into

two categories: roughages and concentrates. Roughages are higher in fiber than concentrates. Concentrates are higher in energy and protein than roughages.

Proteins are made up of amino acids, and provide nutrients to build and maintain body tissues. Carbohydrates can be either simple or complex, and provide the animal with energy. Fats (or lipids) help maintain healthy skin and a healthy nervous system. Vitamins and minerals are necessary to maintain proper body function, to fuel chemical reactions in the body, and for increased growth. Animals need large amounts of clean, fresh water to properly digest foods and maintain body functions.

Some feeds may contain additives to improve their overall effectiveness. Feed additives include antibiotics, hormones, anthelmintics (dewormers), and probiotics. Feed additives are closely regulated by the Federal Food and Drug Administration (FDA) and the United States Department of Agriculture (USDA).

There are two classes of concentrates: protein supplements and energy feeds. Animal feeds with less than 20 percent crude protein are called energy feeds. Feeds with more than 20 percent protein are referred to as protein supplements.

A ration is the total amount of feed given to an animal in a 24-hour period. The term diet refers to the type and amount of feed provided to an animal over a period of time. There are two different ways in which feed can be provided to animals: free access and scheduled feeding. Free access allows animals to eat as much as they choose. Scheduled feeding regulates the amount of food an animal can eat. There are six major factors to consider when determining the type and amount of animal feed. These are: maintenance, growth, fattening, production, reproduction, and work. A feed tag lists the amounts of some vital vitamins and minerals, plus percentages of protein, fat, and fiber. It will state, in general terms, what ingredients are mixed together to create those percentages.

Quick Facts

- The nutritional needs of animals will vary, based on characteristics such as age, use, and production type.
- Animals can be classified as either carnivores, omnivores, or herbivores.
- Non-ruminants or monogastrics are animals that have a single stomach which breaks down the nutrients in food for the animal's use.
- Ruminants are animals with a four-compartment stomach that

can digest many different types of roughage.

- Feed can be classified as roughage if the feed contains more than 18 percent crude fiber.
- There are six basic nutrients needed by animals: proteins, carbohydrates, fats (lipids), vitamins, minerals, and water.
- Concentrates are high in energy content, are easily digestible, and contain less than 18 percent crude fiber.
- A concentrate with less than 20 percent crude protein is called an energy feed.
- A concentrate with 20 percent or more crude protein is called a protein supplement.
- Proteins are organic compounds composed of amino acids.
- Carbohydrates provide most of the energy requirements for livestock.
- Vitamins (organic) and minerals (inorganic) are necessary for the proper absorption of fats and carbohydrates, and for the many chemical reactions that take place in the body.
- A deficiency is a lack of a certain vitamin or mineral in an animal's system.
- Water makes up 65 percent of an animal's body. Water regulates temperature, and is vital for organ functions such as digestion, waste

removal, and the absorption of nutrients.

- Feed additives are ingredients added to animal feeds to improve growth and health. Feed additives include hormones, anthelmintics, antimicrobial substances and probiotics.
- Hormones are naturally produced in the animal's body. Hormones regulate many body functions, such as growth, metabolism, and the reproductive cycle.
- Anthelmintics (dewormers) may be given to the animal in either feed or water, or applied to the animal's coat to control internal parasites.
- In the United States, the use of feed additives and hormone implants is strictly regulated by the Federal Food and Drug Administration (FDA) and U.S. Department of Agriculture (USDA).
- Feed is the major cost in animal production, and accounts for up to 75 percent of the total cost of raising animals.
- A ration is the amount of feed given to an animal in a 24-hour period.
- The diet of an animal should be based on six main factors: maintenance, growth, fattening, production, reproduction, and work.
- A feed tag is the label attached to a bag of commercial feed.
- Any feed that contains any level of medication is defined as a medicated feed.

Student Learning Activities

1. Have students make a bulletin board of the six nutrient categories.
2. Have a nutritionist come into the classroom and speak to students about his/her profession.
3. Visit a livestock production facility, and have the students design a complete feed ration for the animals.
4. Visit a commercial feed mill to see how feedstuffs are mixed into commercial feed.
5. Have students bring in feed tags and mix their own rations for different livestock according to the information on the tags.

Discussion Questions

1. What is a nutrient?
2. List the six main types of nutrients and briefly describe each one.
3. What is the difference between roughages and concentrates?
4. Why are feed additives and hormones such a controversial issue?
5. Explain why the diets of animals that do work or are lactating are different from other animals.

Review Questions

True/False

1. Ruminants are animals that have a single stomach, which produces acids to break down nutrients in food for the animal's use.
2. Proteins are organic compounds composed of amino acids.
3. Corn is the most widely used energy feed.
4. Saturated fats are liquid at room temperature.
5. If a feed has a pleasant taste, it is said to be palatable.

Multiple Choice

1. Vitamin _____ is a water-soluble vitamin.
 - a. A
 - b. C
 - c. D
 - d. K
2. Feedstuffs are classified as concentrates if they contain less than _____ percent crude fiber.
 - a. 18
 - b. 17
 - c. 19
 - d. 26
3. Feed accounts for up to _____ percent of the total cost of raising livestock.
 - a. 68
 - b. 35
 - c. 89
 - d. 75
4. One of the best sources of crude protein is _____.
 - a. corn
 - b. oats
 - c. soybean meal
 - d. hay
5. The two types of feeding are scheduled feeding and _____ feeding.
 - a. two-a-day
 - b. three-a-day
 - c. free-for-all
 - d. free access

Completion

1. Humans, swine, and poultry are considered to be _____.
2. _____ are the ingredients used to formulate animal diets.
3. _____ are the building blocks of proteins.
4. A _____ is a lack of a certain vitamin or mineral in an animal's "system."
5. _____ are live microorganisms, such as yeasts and bacteria, added to feed to improve digestion.

Short Answer

1. Describe the differences in the nutritional needs of animals.
2. What are the six major functions associated with nutrition?
3. Why is it important to regulate additives in feedstuffs?
4. What are the six basic nutrients needed by animals?
5. What are two controversial additives that are sometimes added to animal feeds?



Section 3

ANIMAL REPRODUCTION

- CHAPTER 7 Genetics and Animal Reproduction
- CHAPTER 8 Biotechnology in Animal Science
- CHAPTER 9 Animal Breeding Systems

FFA AND 4-H CONNECTION



The following is a partial list of activities in which a student may participate using knowledge obtained in a livestock or companion animal program. Students should consult local and state youth organizations, such as the National FFA Organization and 4-H, to determine livestock-related programs available in their area.

- Agricultural Marketing
- Agricultural Sales
- Agriscience Fair
- Animal Nutrition
- Food Science and Technology
- Junior Livestock Shows
- Junior Market Shows
- Livestock Evaluation
- Meats Evaluation and Technology

Proficiency Awards (FFA)

- Diversified Agricultural Production
- Diversified Livestock Production
- Specialty Animal Production
- Veterinary Medicine





CHAPTER 7

Genetics and Animal Reproduction

OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Explain how genetics relates to improvement in animals.
- Describe how cell division occurs in mitosis and meiosis.
- Explain how animal characteristics are transmitted.
- Explain sex determination in mammals and birds.
- Describe mutations in DNA.

KEY TERMS

genetics
environment
heritability
heritability
estimate
protoplasm
cell membrane
nucleus
chromosome
cytoplasm
zygote
mitosis

meiosis
haploid
gamete
sperm
ovum
fertilization
diploid
asexual
reproduction
genotype
phenotype
gene

deoxyribonucleic
acid (DNA)
ribonucleic acid
(RNA)
allele
dominant gene
recessive gene
homozygous
heterozygous
incomplete
dominance
codominance
mutation

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Heredity	Hérédité	Vererbung	Eredità	La Herencia
Genetics	Génétique	Genetik	Genetica	La Genética
Parent	Mère	Elternteil	Genitore	El Padre
Dominant	Dominant	Dominant	Dominante	Dominante

genetics

the study of how traits (or characteristics) are passed from the parents to the offspring

Animal Genetics

Animal improvement through a planned breeding program starts with an understanding of basic genetics. Animals today perform better and produce more meat, milk, eggs, and wool faster on less feed than ever before. Most of the progress in animal production is the result of selective breeding for genetic improvement. Good breeding programs are based on the application of the principles of **genetics** (Figure 7-1).

An Austrian monk, Gregor Mendel, is considered to be the father of genetics. Mendel outlined the principles of inheritance after doing years of genetic experiments with the garden pea (*Pisum sativum*) in the 1800s. He proved that certain characteristics are passed from parent to offspring. Animal breeders use these genetic principles to breed animals that produce offspring with desirable characteristics.



©Stockphoto/Marcel Moolij

FIGURE 7-1

Producers rely on genetics to pass on desirable traits from the parent animals to their offspring.

environment

the conditions in which an animal is raised

heritability

the likelihood of a trait being passed from parent to offspring

heritability estimate

the measure of how much of a trait a parent can pass to the offspring

protoplasm

the living matter of a cell

cell membrane

the structure that encloses the cell

nucleus

the core of the cell that houses the genetic material

chromosome

nuclear material that determines hereditary characteristics

cytoplasm

the substance of the cell outside of the nucleus

zygote

a fertilized egg cell

Not all differences in animals are caused by genetics. Some are caused by the **environment**, or the conditions under which the animals are raised. Producers must constantly seek to provide the best environment for animals, as well as maintain the best genetics.

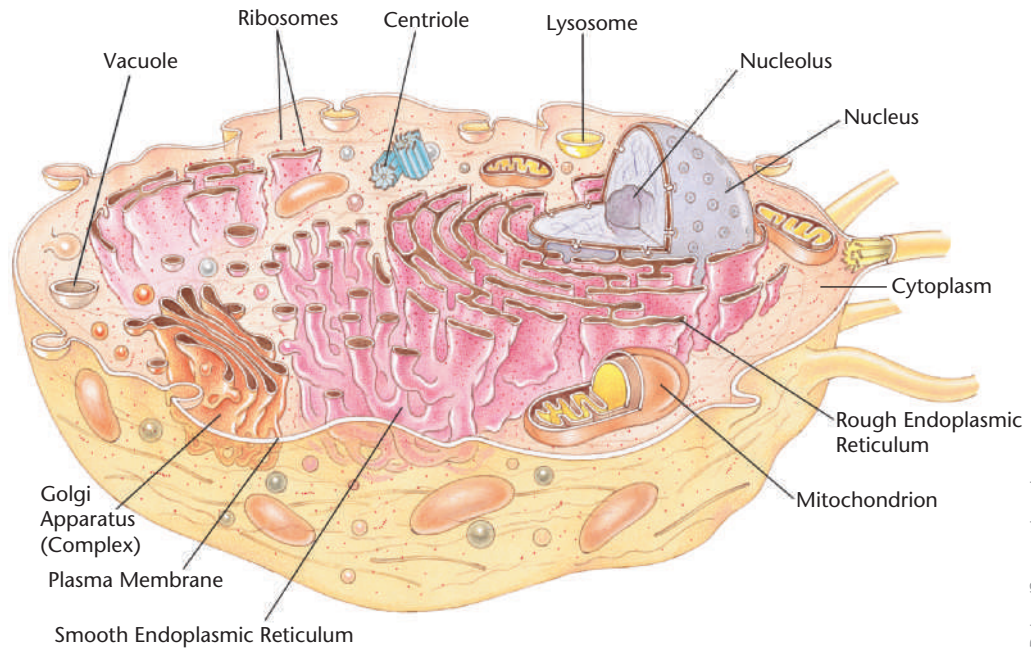
Heritability is the likelihood of a trait being passed on from the parent to the offspring. A **heritability estimate**, which is expressed as a percent, is the measure of how much of a trait of a parent is passed to the offspring. If a trait is highly heritable, improvement in the herd can be achieved in just one or two generations. The improvement is slow for traits with low heritability. The heritability for swine litter size is very low. That means that improving litter size through breeding may take several generations.

The Cell and Cell Division

The basic building block of an animal's body is the cell. A cell is generally the smallest part of the body that is capable of sustaining the processes of life (metabolism and reproduction). **Protoplasm** is the living substance that makes up a cell. In animal cells, the protoplasm is surrounded by the **cell membrane**. The **nucleus** of a cell contains the **chromosomes** and genes. The genes contain the cell's genetic material, which are instructions that control the activities of the other parts of the cell. The nucleus is surrounded by the **cytoplasm** (Figure 7-2). The cytoplasm is all the substance of the cell outside of the nucleus.

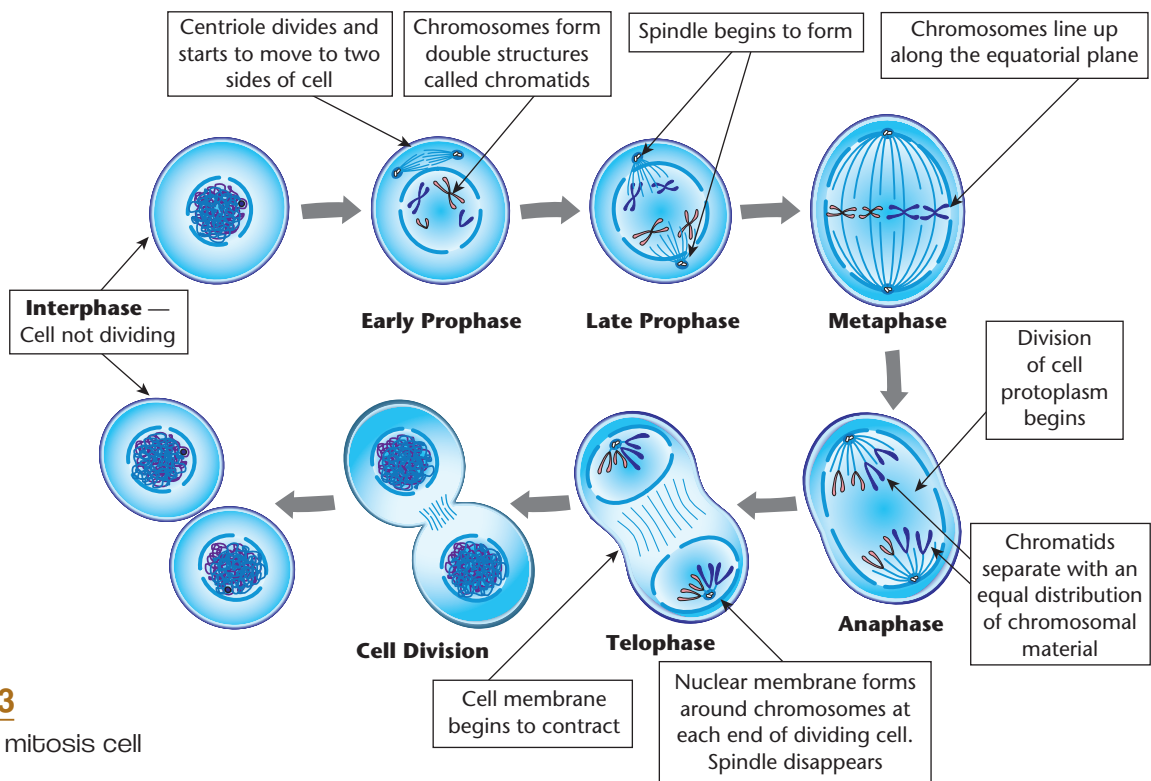
Mitosis

An animal begins as a single cell, called a **zygote**. The zygote is formed when an egg is fertilized by a sperm. The single cell divides to make two cells. The cells continue to divide, and groups of cells form specialized tissues and organs as the animal's

**FIGURE 7-2**

Parts of the animal cell.

Delmar/Cengage Learning

**FIGURE 7-3**

The steps of mitosis cell division.

Delmar/Cengage Learning

mitosis

division of cells which increases the number of body cells resulting in growth

body develops. This division of body cells is called **mitosis**. Mitosis increases the number of body cells, which is the basis for growth.

During mitosis, the chromosome pairs are duplicated in each daughter cell, so they are exactly like the old cell. Figure 7-3 shows the steps in mitosis.

FIGURE 7-4

Numbers of chromosomes of animal species.

Species	Chromosomes	Species	Chromosomes	Species	Chromosomes
Cattle	60	Goat	60	Chicken	78
Swine	38	Horse	64	Rabbit	44
Sheep	54	Donkey	62	Dog	78
Cat	38	Human	46	Mule	63

DeMar/Cengage Learning

A cell that is not dividing is in the interphase stage. During mitosis, there are four typical stages in the division of the cell nucleus, which occur in the following order: prophase, metaphase, anaphase, and telophase.

Chromosomes occur in pairs in the nucleus of cells. Each parent contributes one-half of the pair. The number of pairs of chromosomes varies by species. For example, a cow cell has 30 pairs or 60 chromosomes. In Figure 7-4, note that each animal has an even number of chromosomes except for the mule (63). Mules are almost always sterile because their chromosomes cannot divide into even pairings. Animals and plants with an uneven number of chromosomes usually produce undesirable characteristics.

meiosis

cell division that creates a sperm or egg cell

haploid

a cell containing a single set of chromosomes, half the number of a normal cell

gamete

a reproductive cell

sperm

male reproductive cell

ovum

female reproductive cell

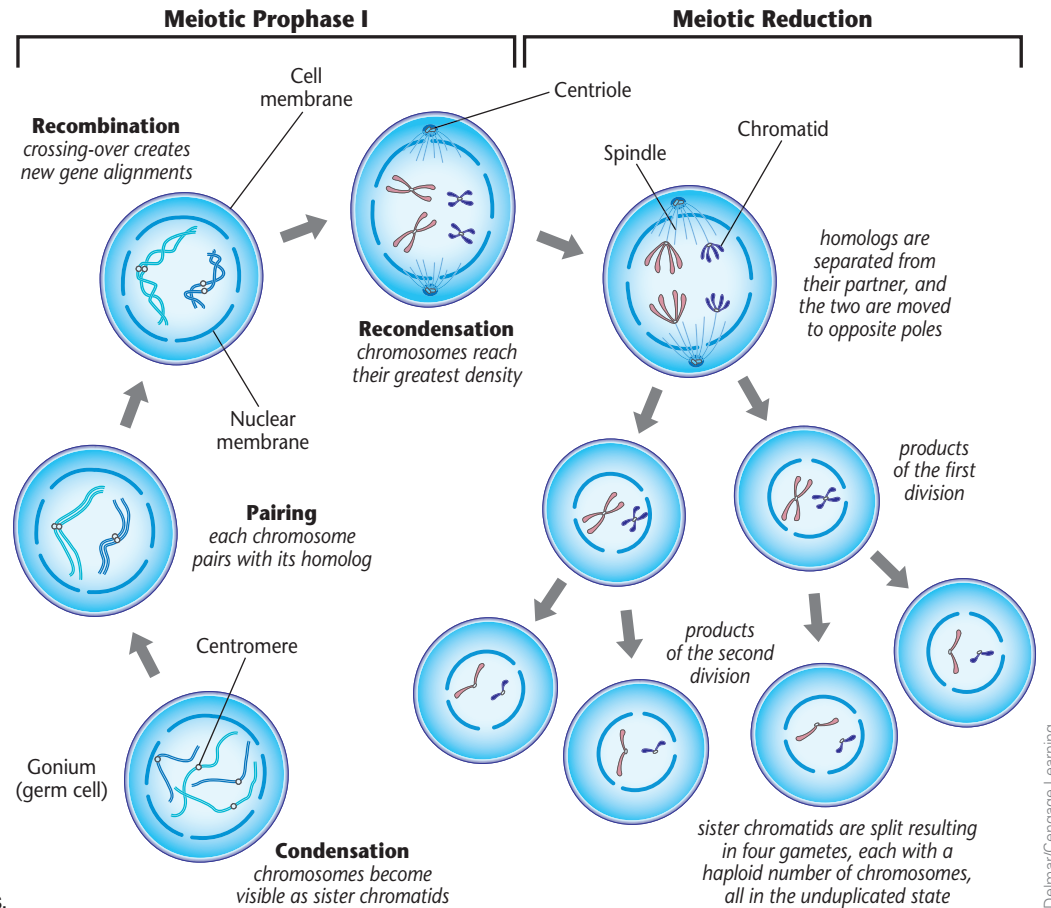
Meiosis

Cell division that results in the production of a sperm or egg cell is called **meiosis** (Figure 7-5). Cells produced through meiosis, called **haploid** cells, have only half the normal number of chromosomes. Reproductive cells are called **gametes**. The male gamete is called a **sperm** and the female gamete is called an **ovum**, or egg (Figure 7-6). During sexual reproduction, two gametes (one sperm and one ovum) unite to form the zygote.



History Connection

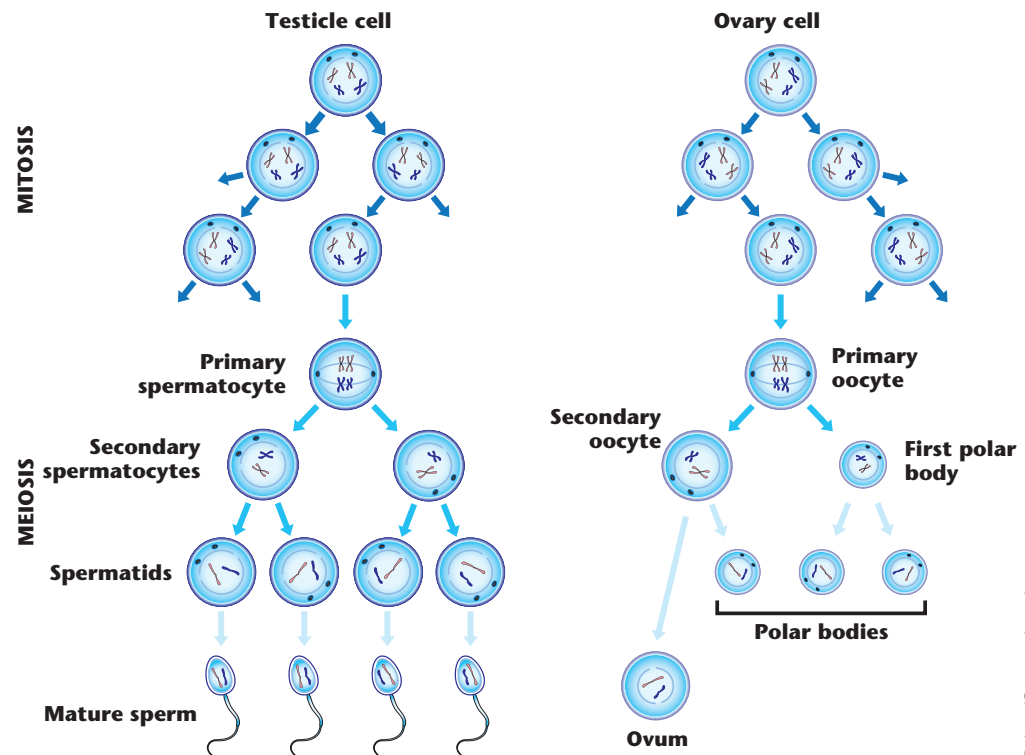
Scientists, like the Greek philosopher Aristotle, thought that each sperm cell contained a tiny complete being inside. They thought that all the genetic information was from the father, and that the mother’s purpose was only to carry the developing child and to give birth. Drawings of sperm cells by early scientists show a tiny human in each sperm cell. Today, we know an offspring receives 50 percent of its traits from the male genes (sperm) and 50 percent from the female genes (egg).



Delmar/Cengage Learning

FIGURE 7-5

Cell dividing by meiosis.



Delmar/Cengage Learning

FIGURE 7-6

The steps in the production of sperm and the ovum.



Science Connection

Students often confuse Mitosis and Meiosis.

Mitosis – the division of body cells leading to growth of the animal

Meiosis – the division of reproductive cells in sexually reproducing organisms. The sperm and egg formed during meiosis unite to form a single cell called a zygote.

Hint: To distinguish the difference in mitosis and meiosis, remember that meiosis is the word with an 'e' as in sex.

fertilization

process of a sperm cell uniting with an ovum (egg)

diploid

a cell that has a full set of chromosomes, one set from each parent; *di* = double, two

asexual reproduction

production of an offspring without sex

genotype

the combination of genes an individual possesses

phenotype

the physical appearance of an animal

gene

a unit of DNA that gives an individual its traits

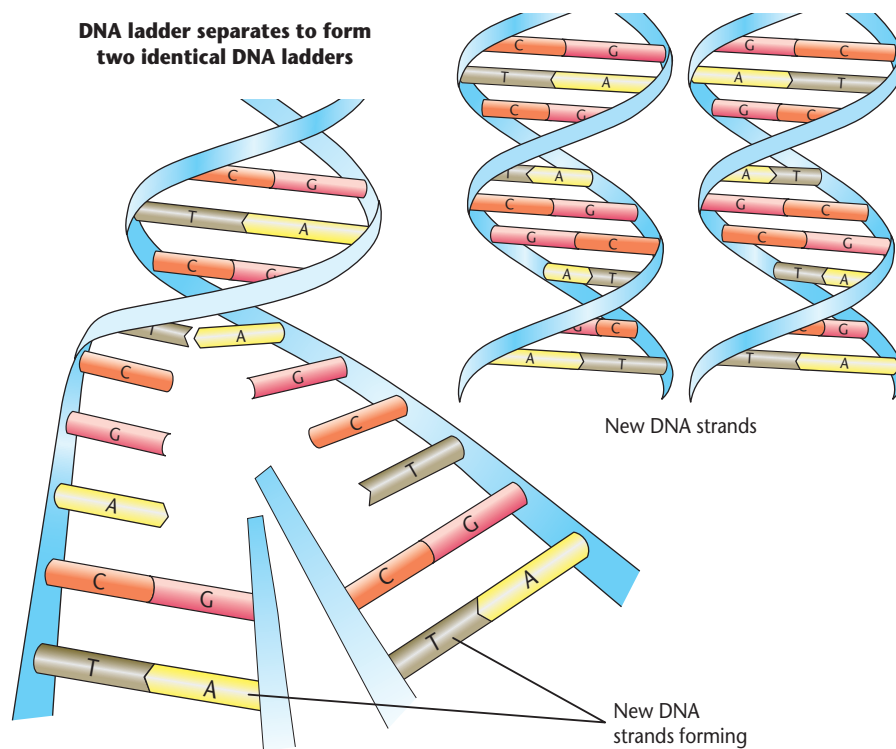
deoxyribonucleic acid (DNA)

the material that determines the characteristics of an organism

Fertilization takes place when a sperm cell penetrates an egg cell (the two haploid cells). The sperm and the egg unite to form one complete cell called a zygote. The zygote is **diploid**; that is, it has a full set of chromosome pairs. The shuffling of genetic material through meiosis results in many different possible combinations of traits for the offspring. This accounts for the genetic variation found in animals reproduced sexually. **Asexual reproduction**, reproduction without sex, such as that which occurs through cloning, does not produce genetic variation. In clones, the parent and offspring are genetically identical.

The Coding of Genetic Information

The genes of an animal provide the genetic code that is passed from one generation to the next. **Genotype** refers to the combination of genes that an individual possesses. The physical appearance of an animal is referred to as its **phenotype**. **Genes** are located on chromosomes within the nucleus and are composed of DNA, (deoxyribonucleic acid). **Deoxyribonucleic acid (DNA)** is found in the

**FIGURE 7-7**

The DNA helix.

ribonucleic acid (RNA)

carries the genetic information
needed to make proteins in cells

nucleus of all cells of all living organisms. Information contained in DNA determines the characteristics of the organism (Figure 7-7). One important characteristic of DNA that makes biotechnology possible is that certain pieces of DNA from a living organism can function when they are transferred into another organism. DNA is made of the same chemicals for all living things.

Ribonucleic acid (RNA) is very similar to DNA. The primary function of RNA is to carry genetic information needed to make (synthesize) proteins in cells. RNA is a “throwaway” copy of the DNA that leaves the nucleus. It transfers the pattern of how animal tissues are to be constructed to the rest of the body, so that growth, maintenance and repair can be carried out.

Genes

Because chromosomes occur in pairs, the genes that they carry are also paired. If both genes code for the same trait, the gene pair is said to be homozygous.

allele

a gene that, when paired, codes for a different characteristic of the same trait

In some gene pairs, each gene codes for a different trait. In this case, these alternative forms of the genes are called **alleles**, and the gene pair is said to be heterozygous. For example, one allele may code for black color and the other may code for red color. The same trait is being affected, but the alleles are coding for different characteristics of the traits.

The genes ultimately determine the physical characteristics of the animal. Environmental conditions may also influence the physical appearance of an animal. For example, a beef animal may possess genes for a high rate of gain, but the feed it receives will determine its actual rate of gain.

Some traits are controlled by a single pair of genes. However, most traits are controlled by many pairs of genes. For instance, carcass traits, growth rate, and feed efficiency are controlled by many pairs of genes.

Dominant and Recessive Genes

dominant gene

a gene that hides the effect of the gene it is paired with

recessive gene

the gene that is hidden when paired with a dominant gene

A **dominant gene** hides the effect of its allele, the other gene in the pair. The allele that is hidden is called a **recessive gene**. For example, black hair coat in Angus cattle is the result of a dominant gene. Red hair coat in Angus cattle is caused by a recessive gene. When studying genetic inheritance, the dominant gene is represented by a capital letter. The recessive gene is represented by a lowercase letter. In the example of Angus cattle, the dominant gene is written B. The recessive gene is written b. (B = black; b = red).

Some other examples of dominant and recessive traits are:

- ◀ Polled (not having horns) is dominant over the presence of horns in cattle.
- ◀ White face in cattle is dominant to a colored face.
- ◀ Black in horses is dominant to brown.

- ◀ Rose comb in chickens is dominant to single comb.
- ◀ Pea comb in chickens is dominant to single comb.

homozygous

a gene pair that carries identical genes for a trait

heterozygous

a gene pair that carries two different genes for a trait

		Male (Pp)	
		P	p
Female (Pp)	P	PP	Pp
	p	pP	pp

Delmar/Cengage Learning

FIGURE 7-8

This cross, if carried out four times, would likely produce three calves without horns (PP, Pp, pP) and one calf with horns (pp).

incomplete dominance

a genetic occurrence when each gene in an allele is only partially expressed

Homozygous and Heterozygous Gene Pairs

A **homozygous** gene pair is one that carries two identical genes for a trait. For example, a polled cow might carry the gene pair PP. A horned cow must carry the gene pair *pp*. For a cow to have horns, it must carry two recessive genes for the horned trait.

A **heterozygous** gene pair is one that carries two different genes (called alleles) that affect a trait. For example, a polled cow might carry the gene pair Pp. This cow is polled (because the P gene is dominant), but carries a recessive gene for the horned trait. If this cow is mated to a bull with a gene pair Pp, some of the calves will be polled and some will have horns.

Predicting Results of Genetic Crosses

It is possible to predict the results of crossing animals with various kinds of genotypes. The Punnett square in Figure 7-8 shows the predicted results of genetic combinations for a cow without horns that carries the (Pp) gene crossed with a bull without horns (Pp). The more genes involved in a characteristic, the harder it is to predict the outcome.

Incomplete Dominance

When a heterozygous condition exists for a given trait, one allele is not always dominant over the other. **Incomplete dominance** occurs when each allele in the pair is only partially expressed. This

usually produces a phenotype in the offspring that is intermediate between the phenotypes that either of the alleles would express.

Codominance

codominance

a genetic occurrence when neither allele dominates the other, and both are fully expressed

Codominance occurs when neither allele dominates the other, and both are fully expressed. This affects the offspring's phenotype by making it neither dominant nor recessive. The roan coat color in animals is a classic example. Roan color is made up of white hairs intermingled with hairs of another color such as red or black. Figure 7-9 shows a red roan cow.

Sex Determination

Sex determination of offspring can help producers of livestock. While some producers may want more females than males, such as those in the dairy industry, other producers, such as beef producers, would want to produce more males. Dairy heifers are needed for replacements in the milking herd. Beef producers want more males because they grow faster. Backyard poultry enthusiasts need many females (hens) but probably only one rooster.



FIGURE 7-9

White and red hairs are mixed together to form the roan color of this animal.

		Female (XX)	
Male (XY)		X	X
	X	XX	XX
	Y	XY	XY

Delmar/Cengage Learning

FIGURE 7-10

There is a 50% chance of the offspring being male/female. In mammals, the male (XY) determines the sex of the offspring.

		Female (ZW)	
Male (ZZ)		Z	W
	Z	ZZ	ZW
	Z	ZZ	ZW

Delmar/Cengage Learning

FIGURE 7-11

In birds, the female (ZW) determines the sex of the offspring.

mutation

an abnormal change in the DNA

Mammals The sex of the offspring in mammals is determined by the male (sperm) at the moment of fertilization. Males have two distinct sex chromosomes (XY). Females have two of the same sex chromosomes (XX). At fertilization, if the zygote gets a Y chromosome from the father, it will be a male (XY). If the zygote gets an X chromosome from the father, it will be a female (XX). The Punnett square in Figure 7-10 shows all the possible combinations of the XY (male) and XX (female) chromosomes.

Birds In birds, the female determines the sex of the offspring. The male carries two of the same sex chromosomes (shown as ZZ). The female carries two distinct sex chromosomes (ZW). The Punnett square in Figure 7-11 shows all the possible combinations of the ZZ (male) and ZW (female) chromosomes.

Mutation

DNA can be thought of as the blueprint of the animal. Occasionally, something will happen to cause a permanent change in the DNA sequence of a gene, changing the blueprint. An abnormal change in the DNA is called a **mutation**. Mutations are rare and DNA is normally passed from parents to offspring unchanged. Some mutations are beneficial to the animal, some are harmful, and some have no effect. Some mutations occur by chance, while some are caused by such things as exposure to radiation and chemicals.

An example of a beneficial mutation is polled (without horns) Hereford cattle. Around 1900, an Iowa farmer noticed that some Hereford cattle never grew horns. The gene for horns had mutated and failed to produce a horned calf. The polled condition is dominant, so any cross of parents in which at least one parent was polled would produce a polled calf. (Figure 7-12)



Courtesy of USDA

FIGURE 7-12

The polled condition (lack of horns) is a good example of a gene mutation. In this case, the mutation was a desirable change.

Summary

Much of the improvement in animals is the result of using the principles of genetics. The work of Gregor Mendel proved that parents pass their traits to their offspring. The amount of difference between parents and offspring is caused by genetics and the environment. Heritability estimates are used to show how much of a trait might be inherited by the offspring.

An animal's body is made up of cells. Animals grow by cell division. The nucleus of the cell contains chromosomes, which are found in pairs. In zygotes, one chromosome set comes from the father and one comes from the mother.

Ordinary cell division is called mitosis. In mitosis, each new cell is exactly like the old cell. The cells resulting from mitosis are used for growth, maintenance, and repair in the body.

The reproductive cells produced by meiosis are called gametes. In meiosis, the chromosome pairs split, and each chromosome of a pair goes to a different gamete. The male gamete is called a sperm. The female gamete is called an ovum or egg. Fertilization occurs when the sperm penetrates an egg and the two gametes unite to form a zygote. The chromosome pairs are formed again when fertilization takes place.

Genes are units of DNA that control an animal's traits. Genes are found on the chromosomes. Some traits are controlled by a single pair of genes. Other traits are controlled by combinations of genes. Some genes are dominant; others are recessive. Dominant genes hide or mask the effects of recessive genes. Some genes are neither dominant nor recessive, and result in a mixture of the two gene effects.

An animal may carry two dominant or two recessive genes for a trait. These are called homozygous pairs. Some animals have a dominant and a recessive gene, forming a heterozygous pair. It is possible to predict some results of the mating of two animals by using a Punnett square.

Quick Facts

- Heritability is the measure of how much of a trait is passed on from a parent to the offspring.
- The nucleus contains the hereditary material of the cell, that is, the chromosomes that contain the genes.
- The division of body cells for growth, tissue repair, etc. is called mitosis.
- Meiosis is the process of division in sexual reproduction to produce the sperm or ovum.
- Genes are located on chromosomes and are composed of DNA.
- Deoxyribonucleic acid (DNA) is a nucleic acid that contains the genetic instructions used in the development and function of all known living organisms.
- Ribonucleic acid (RNA) transfers the genetic code in DNA to the rest of the cell to assist with reproducing body tissues.
- A homozygous gene pair is one that carries two identical genes for a trait, and a heterozygous gene pair is one that carries two different genes (called alleles) that affect a trait.
- Incomplete dominance occurs when each allele in the gene pair is only partially expressed.
- Codominance occurs when neither allele in a heterozygous condition dominates the other and both are fully expressed.
- In mammals, the male determines the sex of the offspring.
- In birds, the female determines the sex of the offspring.
- Mutations are abnormal changes in the DNA.
- Some mutations are beneficial to the animal while other mutations are harmful.

Student Learning Activities

1. Prepare an oral report, including visual aids, on a phase of mitosis and meiosis.
2. Select an animal species and make a list of traits you think are due to genetics and a list of the traits you think are due to the animal's environment.
3. When planning and conducting a supervised agricultural experience program in animal production, use the principles of genetics for selecting breeding stock.
4. Invite a genetic specialist to speak to the class.
5. For a selected animal species, make a list of the most desirable traits.

Discussion Questions

1. Describe mitosis.
2. Describe meiosis.
3. What is fertilization in sexual reproduction?
4. Define the terms “dominant gene” and “recessive gene.”
5. Explain how sex determination is different in mammals as compared to birds.

Review Questions

True/False

1. Genetics accounts for all differences in animals.
2. The female determines the sex of mammals.
3. Gregor Mendel is considered the father of genetics.
4. All genes are located in the cytoplasm of cells.
5. Animals grow by cell division (mitosis).

Multiple Choice

1. In poultry, the sex of the offspring is determined by the _____.
 - a. male
 - b. female
 - c. both the male and female
 - d. sometimes the male and sometimes the female
2. Genotype refers to the _____.
 - a. number of genes
 - b. placing of genes
 - c. splicing of genes
 - d. genetic makeup of the animal
3. When chromosome pairs are divided in such a manner that each gamete has one of each chromosome, the process is called _____.
 - a. mitosis
 - b. cell division
 - c. sequencing
 - d. meiosis
4. Reproduction of body cells is a process known as _____.
 - a. meiosis
 - b. mitosis
 - c. fertilization
 - d. splicing
5. Ribonucleic acid (RNA) is a copy of the DNA that is carried from the _____ to other parts of the cell.
 - a. zygote
 - b. nucleus
 - c. cytoplasm
 - d. ovum

Completion

1. The polled condition in Hereford cattle is a result of a _____.
2. Genes are located on _____.
3. The _____ is the control center of the cell.
4. Cattle have _____ pairs of chromosomes.
5. _____ is closely related to DNA.

Short Answer

1. What are the two factors responsible for genetic variation in animals?
2. Why are mules usually unable to reproduce?
3. Define mutation.
4. Explain incomplete dominance.
5. Explain the Punnett Square system of genetics.



CHAPTER 8

Biotechnology in Animal Science

OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Discuss the use of biotechnology in animal science.
- Discuss the use of genetic engineering in animal science.
- Explain current biotechnology practices in animal science.
- Explain the objections some have to the use of biotechnology.
- Describe how biotechnology may be applied to future agricultural practices.

KEY TERMS

biotechnology
patent
asexual
clone
genetic
engineering

bovine
somatotropin
(BST)
recombinant bovine
somatotropin
(rBST)

superovulation
oocyte
embryo transfer
in vitro
fertilization (IVF)

LANGUAGE CONNECTION

English	French	Spanish	German	Italian
Biotechnology	Biotechnologie	La Biotecnología	Biotechnologie	Biotecnologia
Clone	Clone	El Clon	Klon	Clone
Science	Science	Las Ciencias Naturales	Wissenschaft	Scienza

biotechnology

the modification of living organisms
to produce a more desirable product

Biotechnology

Biotechnology is the modification of living organisms to produce a more desirable product (Figure 8-1). Many people think biotechnology is a relatively new and modern development. In actuality, biotechnology has been around for thousands of years. When humans first domesticated animals, they decided which characteristics they wanted in their livestock, and then selectively bred for those traits. Selective breeding is a form of biotechnology.



FIGURE 8-1

Biotechnology is the modification of a living organism to produce an alternative outcome.

Courtesy of USDA, Scott Bauer

Modern biotechnology is rapidly expanding and improving. The uses and applications of biotechnology today go beyond the simple breeding practices of the past. Great strides have been made in animal productivity and performance using biotechnology, with even greater potential for advancements in the near future. Many new biotechnology tools and methods are being developed and applied each year. The expanding field has created many new career opportunities, including production, processing, sales and marketing, and research and development.

Biotechnology is used to improve animal traits, resulting in improvements in animal health and productivity. These benefits are helpful to the producer and to the consumer. The manipulation of DNA has furthered the biotechnology movement (Figure 8-2). Since the 1970s, scientists have been able to identify and manipulate DNA. In recent years, scientists have been able to read, sequence, and record all the codes of DNA in certain species of animals and plants. This facilitates rapid improvement in the genetics of these species.

The United States leads the world in the development and use of biotechnology in agriculture. However, there is resistance to the use of biotechnology,

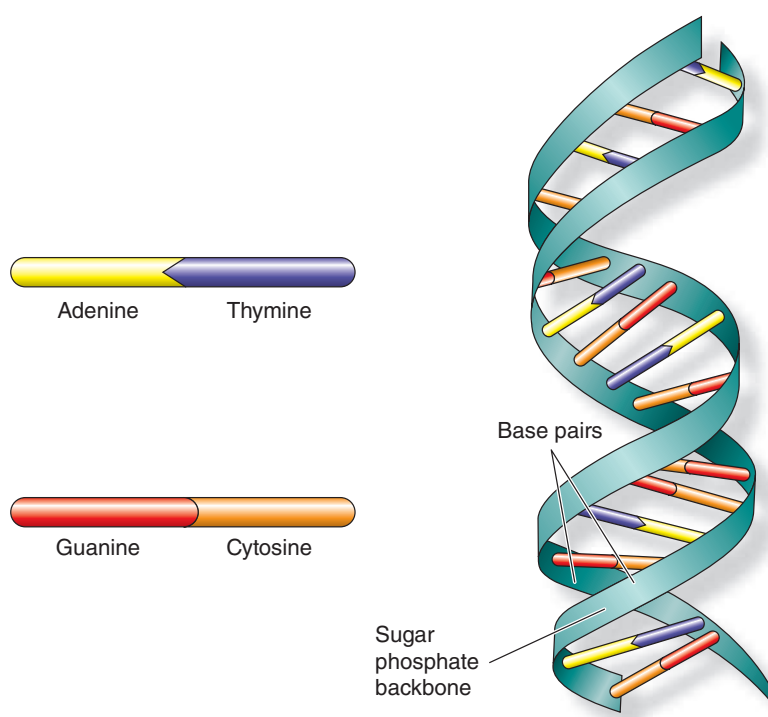


FIGURE 8-2

In the 1970s, scientists began to be able to read, sequence, and record the DNA code.

especially genetically modified organisms (GMOs), both in the United States and in other countries. When governments in other countries object to U.S. production practices, they sometimes impose import bans on U.S. products, affecting the economy.

Regulation and Safety in the Use of Biotechnology

There are three federal agencies that are involved in the regulation of biotechnology in the U.S.: the United States Department of Agriculture (USDA), the Food and Drug Administration (FDA), and the Environmental Protection Agency (EPA).

The USDA is responsible for meat and poultry products, while the FDA is responsible for all other domestic and imported foods and animal drugs. The EPA regulates the use of pesticides, toxins, and other potential pollutants. The standards of safety are the same for products produced from biotechnology and non-biotechnology products. Biotechnology products must be proven safe for human consumption and use, and must not have a negative impact on the environment.

did you know?

Advances in biotechnology have provided the United States with cleaner, safer food. Thanks to biotechnology, foods can be quickly and easily checked for pathogens such as salmonella, *E. coli*, and listeria.

patent

a legal document that gives exclusive rights to the inventor of a product for the use and sale of the product

Patents and Genetic Engineering

Genetically engineered organisms, including animals, can be patented by the developer through the U.S. Patent Office. A **patent** gives exclusive rights to the inventor for the use and sale of the product. Anyone using an animal or other organism that has been patented must pay a fee to the developer for its use.

Applications of Biotechnology

Biotechnology includes an ever-increasing array of techniques to change living organisms for the benefit of man. Techniques include cloning, genetically modified organisms, breeding selection, embryo

transfer, artificial insemination, and sexing of semen. One way humans benefit from medical biotechnology applied to animals is the use of replacement organs from animals, such as the use of pig heart valves in humans. Possibilities for the applications of biotechnology seem limitless.

Cloning

asexual

reproduction without sex

clone

an organism that is genetically identical to its parent



Courtesy of Dr. Steven Stice, The University of Georgia

FIGURE 8-3

George and Charlie were the first calves that were genetically altered clones.

Cloning is the production of an organism by **asexual** (without sex) means, with the offspring having the exact same genetic makeup as the parent organism. **Clones** are a way to duplicate genetically superior animals (Figure 8-3).

The most notable cloning of an animal from mature body cells occurred in Scotland in 1996. Researchers cloned a sheep named Dolly from a mammary gland cell of an adult sheep. After embryo growth began, the egg cell was transplanted into a surrogate ewe to develop into a fetus. Dolly was the beginning of a new agricultural technology that sparked interest as well as fear.

Although expensive, cloning is quickly becoming commercially available (Figure 8-4). Clones are used as breeding animals and to improve the health and genetics of offspring. The offspring of clones and successive generations are the animals that will be used for food. Other benefits of cloned animals include increased milk production and healthier animal foods. In 2008, the U.S. FDA ruled that livestock clones and



Getty Images Inc./Neil Beer

FIGURE 8-4

Twins and triplets can be considered clones if they came from the same zygote.

their offspring were as safe to eat as any other foods. There are now companies that will produce genetic clones of a producer's best animals.

It is becoming common for beloved family pets, such as dogs and cats, to be cloned. In 2009, a family paid \$155,000 for their family dog to be cloned.



History Connection

While Dolly the sheep is the most famous clone, she was not the first. Robert Briggs and Thomas King performed the first successful cloning in 1952. It was a tadpole.

genetic engineering

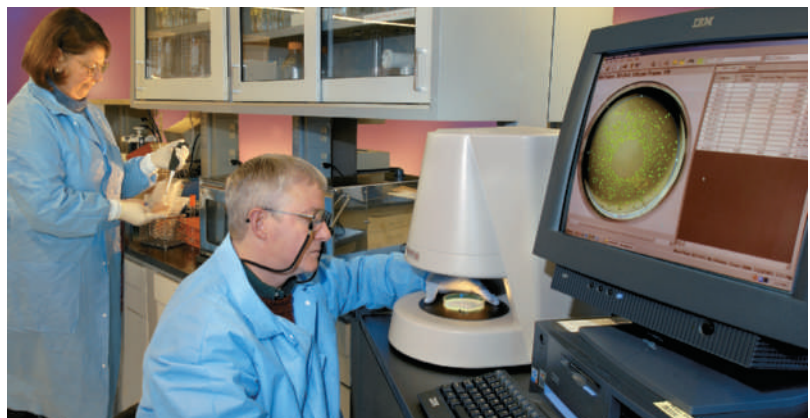
the process of identifying and transferring a gene or genes for a specific trait from one organism to another

Genetic Engineering

Genetic engineering is the process of identifying and transferring a gene or genes for a specific trait from one organism to another (Figure 8-5). Deoxyribonucleic acid (DNA) is a long strand of many genes. Genes control the characteristics, or traits, of the organism.

Genetic engineering is a complex technology. There are many thousands of genes in plants and animals. Many years of research are sometimes necessary just to identify and locate the genes that control certain characteristics.

One of the problems faced by researchers in genetic engineering is that many of the characteristics they want to change are controlled by a number of different genes rather than by a single gene. This makes it hard for researchers to find the combination of genes that control a certain characteristic.



Courtesy of USDA, Paul Pierlott

FIGURE 8-5

Genetic engineers can manipulate strands of DNA.

bovine somatotropin (BST)

a hormone produced naturally in the pituitary gland of cows that helps to regulate the ratio of energy that is used for milk production versus the energy used for fat production



Courtesy of USDA-ARS

FIGURE 8-6

Injecting BST increases milk production in cattle.

recombinant bovine somatotropin (rBST)

a genetically engineered duplicate of the natural hormone BST that is used to increase milk production in cows

Bovine Somatotropin (BST)

One of the most successful but controversial uses of genetic engineering has been the use of **bovine somatotropin (BST)** with dairy cows to increase milk production. BST is a hormone that is produced naturally in the pituitary gland of cattle. BST helps regulate the ratio of energy that is used for the production of milk versus the energy used for fat production. Dairy cattle produce more milk than beef cattle because they produce more BST (Figure 8-6).

A supplementary dose of BST can cause cattle to produce even more milk. Large quantities of BST can be produced at a low cost with the use of genetic engineering. The gene that controls BST production is spliced into the DNA of bacteria that multiply rapidly. These bacteria act like tiny factories that make large amounts of the BST under controlled conditions. The BST is collected, purified, and then injected into the cow. This manufactured hormone is called **recombinant bovine somatotropin (rBST)**. Before the use of bacteria to make BST, the only source was from the pituitary glands of slaughtered cows. Only small quantities were available, and it was very expensive. The recombinant process allows large quantities of rBST to be produced for a fraction of the cost of BST collected from cows at slaughter facilities.

Because BST is a naturally occurring hormone, it can be found in all milk. In addition, BST has been approved for use by the FDA. There is no requirement by the FDA for the mandatory labeling of milk from rBST-treated cows. Some companies prefer to label their milk rBST-free or growth hormone-free, although there is no research indicating that the rBST milk is harmful to consumers.

Animal Reproduction

There are many biotechnologies being used in animal reproduction. They include: artificial insemination, estrus synchronization, embryo transfer, and in vitro fertilization. After artificial insemination (AI) and estrus (heat) synchronization, embryo transfer is the third

superovulation

the process of injecting a cow with a hormone that will induce the release of several oocytes during the estrus cycle

oocyte

an egg cell that will become an embryo upon fertilization by sperm

embryo transfer

the process in which embryos are taken from a superior donor animal and implanted into another animal for development



Courtesy of USDA

FIGURE 8-7

Computer-enhanced embryo transfer.

most commonly used biotechnology. In embryo transfer, a donor cow with superior genetics is chemically induced to superovulate. **Superovulation** is a process of injecting a cow with a hormone to induce the production of several oocytes during the estrus cycle. An **oocyte** is an egg cell or ovum that may be fertilized by a sperm cell to produce an embryo, and ultimately a calf. Oocytes are contained in the ovaries of the female. Normally, a cow produces one oocyte per estrus cycle, and, if fertilized, produces one calf per year. Six to eight oocytes are usually produced by superovulation.

After superovulation occurs, sperm is released into the cow's reproductive tract by artificial insemination. Hopefully, all the eggs will become fertilized by the sperm. The fertilized eggs (ova) develop into embryos in seven days. A saline solution is then used to flush the embryos from the reproductive tract. The embryos collected from the donor cow may be transferred immediately to another cow or they may be frozen for later use. **Embryo transfer**, especially in the cattle industry, has become popular for high-value breeding stock (Figure 8-7).

**Science Connection**

Embryo transfer has become a common practice. The embryos, six or more from each donor cow, are so small they must be examined with a microscope. These tiny embryos are essentially complete cows. Each embryo contains all the genetic material needed to continue to grow, develop, and be born as a calf.

in vitro fertilization (IVF)

the process of fertilizing an egg outside the body

Another procedure is called in vitro fertilization. The term “in vitro” means “in glass” in Latin, and is used to describe a process that takes place in a test tube or culture dish under laboratory conditions. **In vitro fertilization (IVF)** is the process of fertilizing an egg outside the body. With in vitro fertilization, a technician removes unfertilized eggs (oocytes) from the donor cow's ovaries, usually recovering 6-8 useable oocytes after the superovulation procedure has been performed. The oocytes mature in

an incubator and are fertilized with sperm. The resulting zygotes incubate and develop in the laboratory before being placed into the recipient cow. While IVF can produce many fertilized embryos, the expense makes the procedure prohibitive in most cases.

By utilizing embryo transfer and in vitro fertilization, it is possible to produce many more offspring from desirable animals. This allows the producer to rapidly improve the genetics of a herd. The transplanted embryos carry the desirable genetic traits of the donor animal even though they are born and raised by lower-quality host cows. In both embryo transfer and in vitro fertilization, the cow that carries the calf to delivery and raises it makes no genetic contribution to the offspring. Donor cows can be flushed every 6 to 8 weeks, producing around 50–75 embryos per year. Because of the high costs of these procedures, they are generally limited to the most valuable breeding stock. Embryo transfer and in vitro fertilization are commonly used in cattle and horses.

Sexed Semen and Embryos

Two biotechnology techniques that are becoming more commonly used in cattle are sexed semen and sexed embryos. Sexed semen and embryos are desirable to producers who need either male or female animals. For example, dairymen prefer heifer calves, and beef producers often prefer bull calves. Dairy heifers are needed as replacement milking cows in the dairy herd. Male animals generally grow larger and faster than females, so many beef producers prefer bull calves. Embryo sexing in cattle is accomplished by removing a few cells from the embryo and examining the DNA for the presence of a Y-chromosome. A Y-chromosome means the embryo is male (XY).

Sexed semen is available for use in artificial insemination (Figure 8-8). Purchasing sexed semen allows the producer to specify the desired sex of the offspring (XX-female/XY-male). To produce sexed semen, the breeding company separates the sperm based on the X and Y chromosomes; X for female and Y for male.

FIGURE 8-8

Artificial insemination is one of the most commonly used biotechnology practices.



Food Production

In 1798, Thomas R. Malthus predicted that the time would come when Earth's population would outgrow the food supply, causing great human suffering. He predicted that "Population, when unchecked, increases in a geometrical ratio. Subsistence (food) increases only in an arithmetical ratio." As the world's population grows, more food will need to be produced. Countries have historically produced enough food for their population, but this has changed because of the recent explosions in population growth. For example, according to the United Nations, an African country that historically has provided 100 percent of its population's food needs is now only providing 80 percent. The use of biotechnology has the potential to significantly increase food production, and yet cause less damage to the environment.



Science Connection

Did you know that dairy goats are being used for human medical purposes?

Genetically engineered dairy goats are being used to produce a human protein in their milk. This protein prevents dangerous blood clots from forming. Scientists extract the protein and turn it into a medicine that fights strokes, pulmonary embolisms, and other life-threatening conditions.

Opposition to Biotechnology

Some people are opposed to the development and use of genetically engineered products. They fear the possibility of some new type of uncontrollable disease or some adverse effect on their health or the environment. Other people fear that the agricultural industry or government agencies have not done enough research to make the products safe for marketing. Many individuals and groups attempt to stop the use of genetic engineering or greatly restrict its use. Groups have tried to stop the testing and use of genetically engineered agricultural products through the legal system and other means.

The use of biotechnology, including genetic engineering, is based on sound science. Biotechnology promotes agricultural sustainability; it reduces the need for fertilizer, pesticides, feed, fuel, and medications, making animals and land more productive while protecting the environment. Biotechnology is the latest “tool” in livestock production to create leaner, healthier animals in a shorter period of time. Scientists and government agencies have determined that the products of biotechnology are as safe or safer than traditional foods (Figure 8-9).



Courtesy of Dr. Steven Stice, The University of Georgia.

FIGURE 8-9

Eight calves cloned from the same cow.

Summary

The science of altering genetic and reproductive processes in animals is called agricultural biotechnology. Biotechnology includes technologies such as genetic engineering, embryo transfer, artificial insemination, cloning, and in vitro fertilization.

Genetic engineering is based on a technology involving recombinant DNA. This involves taking a tiny bit of DNA containing the desired gene from one organism and splicing it onto the DNA strand in another organism.

Genetic engineering has been used to increase the level of bovine somatotropin (BST) in dairy cows, resulting in higher milk production. Research using genetic engineering holds great potential for increased production in plant and animal agriculture.

Embryo transfer has become an established technology in cattle production. The use of embryo transfer permits the production of many offspring from a single genetically superior animal. Superovulation is the process of inducing a cow to produce many oocytes (eggs) during each estrus (heat) cycle. After fertilization, the new embryos are flushed from the cow and frozen for later use, or placed immediately into other cows that will give birth to and raise the calves.

Another important animal biotechnology used for reproduction is in vitro fertilization, in which unfertilized eggs are removed from a donor cow and then fertilized with sperm. The embryo is then placed back into a recipient cow. While the in vitro fertilization process is usually successful, it is very costly and is therefore not widely used.

A recent advancement in biotechnology is sexing semen. This process allows producers to determine the sex of the offspring before semen is purchased. To produce sexed semen, the breeding company separates the sperm based on the X and Y chromosomes; X for female and Y for male.

Despite the positive aspects of biotechnology, some individuals and groups oppose it due to health and environmental concerns.

Quick Facts

- There are many career opportunities available in the expanding field of biotechnology.
- Biotechnology can improve the traits of animals, which improves animal health and increases productivity.
- The USDA, the FDA, and the EPA are the three federal agencies that are involved in the regulation of biotechnology.
- Genetically engineered organisms, including animals, can be patented by the developer through the U.S. Patent Office, giving the inventor exclusive rights for the use and sale of the product.
- Genetic engineering is a type of biotechnology that has great potential for use in animal agriculture.
- Deoxyribonucleic acid (DNA) is found in the cells of all living organisms.
- Cloning is the production of genetically identical offspring by an asexual technique.
- Genetic engineering is the process of identifying and transferring a gene or genes for a specific trait from one organism to another.
- rBST, used in dairy cows to increase milk production, is a product of genetic engineering.

- In embryo transfer, producers induce a donor cow with superior genetics to superovulate. After fertilization, the embryos are then implanted into other cows.
- In the process of in vitro fertilization, the eggs are fertilized outside the body.
- Semen sexing is the process of identifying X and Y chromosomes and separating them before fertilization. This process is becoming more common as dairy producers prefer female calves and beef producers generally prefer male calves.
- Some individuals and groups are opposed to the development and use of genetically engineered products due to health and environmental concerns.
- Embryos may be sexed to determine gender so they may be sold as male or female.

Student Learning Activities

1. Prepare a poster with information on the uses of biotechnology in animal science.
2. Ask a veterinarian who is familiar with one or more biotechnology techniques to speak to the class.
3. Research and prepare a written report on the possible future uses of biotechnology.
4. List the uses of biotechnology in a selected supervised agricultural experience program.
5. Diagram the steps in embryo transfer, explaining the process involved in each step.

Discussion Questions

1. Define biotechnology.
2. Why is genetic engineering often a difficult process, even for highly trained scientists?
3. Why do dairy producers want to increase the amount of bovine somatotropin (BST) in their herd?
4. Why are some people opposed to the use of biotechnology?
5. Explain some biotechnology practices that are controversial.

Review Questions

True/False

1. Genetic engineering is based on a technology that involves the transfer of genes.
2. New developments in biotechnology have come rapidly.
3. Companies can patent new animals that are developed through biotechnology.
4. Superovulation is used to induce a cow to produce more than one egg.
5. Only the FDA regulates animal biotechnology.

Multiple Choice

1. Bovine somatotropin (BST) is a protein produced in which gland of the cow?
 - a. lymph
 - b. pituitary
 - c. reproductive
 - d. endocrine
2. Genetic engineering has been used to increase the level of bovine somatotropin (BST) in cows, which results in higher _____ production.
 - a. fat
 - b. milk
 - c. calf
 - d. lean meat
3. _____ involves removing unfertilized eggs from a donor cow, fertilizing them in an incubator, and placing them into recipient cows.
 - a. Embryo transfer
 - b. Artificial insemination
 - c. In vitro fertilization
 - d. Cloning
4. A clone has the same _____ as its parent.
 - a. genetics
 - b. environment
 - c. disposition
 - d. all of the above

5. Recombinant bovine somatotropin (rBST) is used mainly in _____ cattle.
- beef
 - fiber
 - dairy
 - horses

Completion

- _____ refers to a process of inducing a cow to produce several oocytes during each estrus cycle.
- The science of altering genetic and reproductive processes in animals and plants is called _____.
- When cells or organisms are genetically identical to each other, they are said to be _____.
- An _____ is a cell that becomes an egg or ovum and may be fertilized by a sperm cell to produce an embryo.
- Asexual reproduction means reproduction of the animal without _____.

Short Answer

- What is biotechnology?
- How is biotechnology used for the benefit of humans?
- How can embryo transfer be used to rapidly improve the genetics of a herd?
- How are population, food, and biotechnology related?
- What are GMOs?



CHAPTER 9

Animal Breeding Systems



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Explain common breeding systems used in animal production.
- Discuss the advantages and disadvantages of using various breeding systems.
- Explain the importance of breeding management.
- Compare and contrast crossbreeding and straightbreeding systems.



KEY TERMS

straightbreeding
crossbreeding
purebred
homozygous
seedstock

inbreeding
closebreeding
linebreeding
outcrossing

grading up
grade animal
hybrid
heterosis

LANGUAGE CONNECTION

English	French	German	Latin	Spanish
Purebred	Pur-sang	Reinrassig	N/A	Castizo
Crossbred	Métis	Gekreuzt	N/A	Mestizo
Sex	Sexe	Geschlecht	Sexus	El Sexo
Breed	Race	Rasse	Seminiun	La Raza
Hybrid	Hybride	Hybride	Hibrida	El Híbrido

Breeding Systems

The breeding system used in agricultural animal production has a direct effect on the profitability of the operation. To make a profit, producers must have large numbers of quality animals to sell. The number and quality of offspring is a direct result of the breeding system and the quality of the breeding stock used. For example, in swine operations, producers are constantly striving to increase litter size, and in cattle operations, a cow is expected to produce a healthy calf every year. The breeding system is a major factor in achieving these goals.

Breeding systems can be divided into two basic categories: straightbreeding and crossbreeding. Mating animals of the same breed and of the same genetic background is called **straightbreeding**, while mating animals of different breeds is called **crossbreeding** (Figure 9-1). Both systems have

straightbreeding

mating animals of the same breed and genetic background

crossbreeding

mating animals of different breeds

FIGURE 9-1

A well-planned crossbreeding system can give producers advantages over a straightbred system. Crossbreds, such as this Hereford-Angus cross cow, are generally more productive than purebreds.



advantages and disadvantages. Effective breeding systems require experience, knowledge of the species, planning, and recordkeeping.

A producer chooses a breeding system according to their desired goals. The purpose of the animals being produced is the major factor to consider when selecting a breeding system.

Straightbreeding Systems

The straightbreeding system has several variations. These include purebred breeding, inbreeding, and outcrossing.

Purebred Animals

A **purebred** animal is an animal that exhibits the preferred characteristics of the breed due to generations of unmixed breeding (Figure 9-2). The characteristics must be passed on from generation to generation. In order for a purebred animal to be considered a purebred, both parents of the offspring must also have been purebreds of the same breed. In most cases, both parents must be registered. A purebred animal may also be registered with its breed

purebred

an animal that exhibits the preferred characteristics of the breed, resulting from generations of unmixed breeding



FIGURE 9-2

Purebred cattle carry the distinctive genetic characteristics of the breed. These Brahman calves display the characteristic long, floppy ears and excess skin for which the breed is known.

homozygous

all animals of a breed generally having the same genetic traits

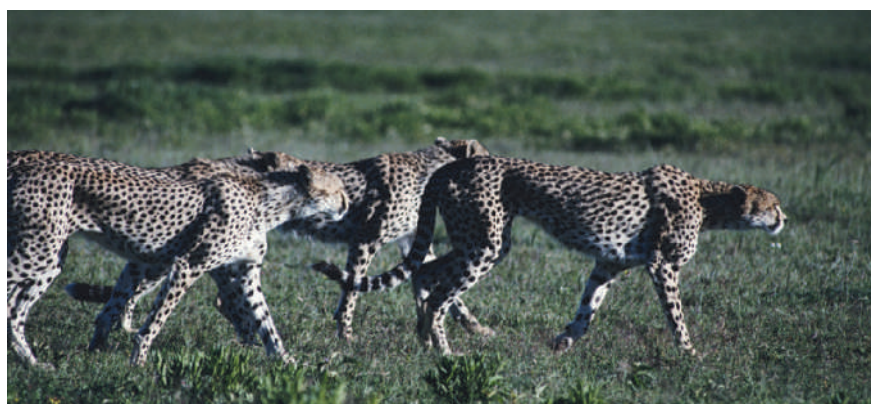
association as long as it meets all the qualifications for being a certified purebred. However, all purebred animals are not registered.

There is a tendency for purebred animals to be genetically **homozygous**. This means that all of the animals of that breed generally have the same genetic traits. This is also a result of inbreeding and linebreeding that took place in the early history of the breed. Inbreeding and linebreeding results in a greater homozygosity of the genes in a given line of animals. In other words, inbreeding and linebreeding were used to create breeds of animals. An inbreeding and linebreeding gene pool is greatly reduced because the genetics of the two parents are very similar.

**Science Connection****IS YOUR CHEETAH RELATED TO MY CHEETAH?**

The cheetah is an endangered species (Figure 9-3). One threat to their survival is the shrinking cheetah genetic pool. Due to climate changes, all but one species of cheetah is now extinct. Cheetahs were forced to reproduce with close relatives. This has greatly reduced the genetic

variation of the entire cheetah population. Most cheetahs share about 99 percent of the same genes (DNA). This is in contrast to most other species that share about 80 percent of genetic material. Inbreeding in cheetahs has led to poor sperm quality, a greater susceptibility to disease, and a lack of ability to adjust to sudden changes in the environment.



PhotoLink/Photodisc/Getty Images

FIGURE 9-3

All cheetahs share about 99 percent of the same DNA.

FIGURE 9-4

Most commercial cattle herds are crossbred. Purebred animals of two different breeds are often mated to achieve heterosis.



Courtesy of Samantha Weeks

Purebred animals are not necessarily better than crossbred animals. For example, a mixed breed dog sometimes inherits the most desirable traits from each parent. The crossbreeding of two unlike animals often results in heterosis, where the offspring is better than either parent (Figure 9-4). With purebred animals, undesirable traits sometime appear in the offspring because of the limited gene pool.

The purebred business is a specialized sector of animal production. It contributes to the continued improvement of animal genetics and animal agriculture. A purebred breeder usually provides purebred seedstock for commercial producers or breeding stock to other purebred breeders. **Seedstock** are animals held for breeding to produce offspring for market. Purebred seedstock animals may be supplied through females, males, semen, or embryos. In the beef cattle industry, purebred bulls are a major portion of the business because a bull can pass his genetics to 25 or more calves per year, while a cow influences the genetics of only one calf per year.

seedstock

animals held for breeding to produce offspring for market

Purebred Registries Purebred registries or breed associations handle the recordkeeping (registration) of purebred animals. Purebred registries were started to maintain the genetic purity of a group of animals with very specific traits. In general,

a purebred animal can be registered as long as both parents are registered purebred animals. Some purebred animals cannot be registered because of certain disqualifications that deviate from the breed's standards. Disqualifications may include a particular color pattern or marking that is seen as undesirable.

did you know?

A Horse of a Different Color – Most purebred animal registries have specific requirements, such as color, for an animal to be registered. Those animals with undesirable traits are not eligible for registration. The American Quarter Horse Association is one organization with strict guidelines for registration. A quarter horse is designated as having a solid body color, but it may have white markings on the face and lower legs. A quarter horse may not have white markings on its body that are more than an inch in diameter (Figure 9-5). However, quarter horses that have any white markings on the body larger than 1 inch may be registered with the American Paint Horse Association (APHA) (Figure 9-6).



Courtesy of Cate Buchanan

FIGURE 9-5

The American Quarter Horse Association (AQHA) will only register horses with limited white markings.



Delmar/Cengage Learning

FIGURE 9-6

The American Paint Horse Association (APHA) will register purebred quarter horses that have too much white to be registered as a quarter horse.

inbreeding

the mating of genetically related animals

closebreeding

breeding of closely related animals; can be traced to more than one common ancestor

linebreeding

breeding of distantly related animals that can be traced to one common ancestor

outcrossing

mating of animals from different families but of the same breed

Inbreeding

Inbreeding refers to the mating of genetically related animals. This means that the animals are bred to a close relative, such as half-brother to half-sister, or father to daughter. Inbreeding is generally not used in commercial animal production. These systems are used in the early stages of breed development, in research, and in other breeding programs to concentrate the genetics of selected individuals for specific purposes. The limited gene pool of inbreeding may concentrate the genes for desirable traits, but also for undesirable traits with unpredictable results. Inbreeding is best left to professional breeders. It requires a carefully planned program of selection and culling to produce desirable traits.

Closebreeding and linebreeding are variations of inbreeding. These terms refer to how closely the two animals being bred are related. In general, neither linebreeding nor closebreeding are recommended except for specific, controlled purposes.

Closebreeding is the most intensive form of inbreeding. Animals that are closebred can be traced to more than one common ancestor. Examples of closebreeding include father to daughter, son to mother, or brother to sister.

Linebreeding is a type of inbreeding that refers to the mating of related animals that are more distantly related than in closebreeding. In linebreeding, each animal can be traced back to only one common ancestor. Examples of linebreeding include cousin to cousin, grandparent to grand-offspring, and half-brother to half-sister.

Outcrossing

Outcrossing is a type of straightbreeding that is commonly used by purebred breeders. **Outcrossing** is the mating of animals from different families but of the same breed. These animals are not closely related and their common ancestors go back at least four generations. The purposes of outcrossing are to

grading up

mating of purebred sires to grade females

grade animal

any animal not eligible for purebred registry

introduce new genetic material into the family and to produce offspring that have the most desirable traits from each family.

Grading Up

Grading up is the mating of purebred sires to grade females. A **grade animal** is any animal not eligible for purebred registry. Most animals on farms in the United States are not purebreds, and are generally referred to as grade animals.

Grading up is a good way to improve the quality of the animals within the herd. The use of a high-quality male, either through natural breeding or artificial insemination, is the fastest way to improve herd genetics since every offspring will carry 50 percent of the genetics of the male.

Grading up can be done economically with the use of artificial insemination (AI). In the case of cattle, for example, the owner of a small herd can AI his cows with purchased semen from a top-performing bull. If the producer uses sexed semen, the result can be 85–90 percent heifer calves carrying half of the bull's genes. With all animals, it is important to select the highest quality sire affordable.



Math Connection

In just three generations, the bulls selected for breeding can be responsible for 87.5 percent of the genetics in a cattle herd. This may not seem correct when you consider that 50 percent of the genetic material is from the dam and 50 percent is from the sire. The bull is responsible for most of the herd's genetic improvement because bulls are changed more often than cows. A bull is replaced every 3 or 4 years, while cows may remain in the herd for 8–12 years. Assuming that heifers from each generation are kept for breeding, in the second generation, the influence of the bull would be 75 percent, in the third generation 87.5 percent, and so on.

Crossbreeding Systems

Crossbreeding also has several variations of breeding systems. Crossbred variations include two-breed crosses, three-breed crosses, and rotation breeding. Crossbreeding is practiced by commercial livestock producers, and occasionally by companion animal breeders. The systems of crossbreeding range from simple to complex.

Crossbreeding is the mating of two animals from different breeds. The offspring from crossbreeding are **hybrids**. Crossbreeding generally results in improved traits in the offspring because dominant genes have masked undesirable, recessive genes (Figure 9-7). Producers that use a crossbreeding program hope to produce animals that demonstrate the best qualities of each parent. For example, crossbreeding a Brahman with a Hereford may result in offspring that have the docile temperament of Herefords and the heat, pest, and disease resistance of Brahman cattle.

hybrid

the offspring from crossbreeding



Math Connection

The Braford cattle breed was the result of crossbreeding Hereford and Brahman cattle. What started out as a simple cross between a Hereford bull and a Brahman heifer, resulting in $\frac{1}{2}$ Hereford and $\frac{1}{2}$ Brahman offspring, developed into a carefully controlled crossbreeding program to develop Braford, a new cattle breed. Braford cattle are approximately $\frac{3}{8}$ Brahman and $\frac{5}{8}$ Hereford.

heterosis

the measure of the superiority of the offspring over the parents

Offspring that result from crossbreeding may exhibit hybrid vigor or **heterosis**. Heterosis is measured by the superiority of the offspring over the parents. The degree and kind of hybrid vigor achieved by crossbreeding varies. The heritability of a gene, which is the measure of how easily the trait is passed on to offspring, also affects the degree to which traits can be enhanced or improved by crossbreeding.

FIGURE 9-7

Commercial producers often use crossbred cows to obtain the benefits of heterosis. (Braford cow and calf)



Courtesy of United Braford Breeders

Animals with desirable traits are selected to be used in crossbreeding programs. Preferred traits in beef cattle include calving ease, high carcass quality, and feed efficiency. Traits valued by swine producers include low backfat percentage, high lean meat yield, and large litter size.

Crossbreeding Increases Productivity

Crossbred animals generally outperform purebreds as a result of heterosis. Crossbreds are generally healthier, and gain weight faster and more efficiently than purebreds. Crossbred breeding stock normally produces better offspring and has a longer reproductive lifespan. While results vary widely, animals from carefully planned crossbreeding programs can increase productivity up to 25 percent.

Almost all commercial cattle, swine, and poultry in the United States are crossbred. Traditionally, the dairy industry used only purebred stock, but crossbreeding dairy cattle is becoming more popular.

Two-Breed Crosses

The two-breed cross is the simplest type of crossbreeding system. In this system, two animals of different breeds are mated. An example would be an Angus bred to a purebred Brahman.

Three-Breed Crosses

A three-breed cross is a combination of three purebred animals. In the Angus and Brahman cross described above, the offspring would be $\frac{1}{2}$ Angus and $\frac{1}{2}$ Brahman. If that offspring were mated to a Hereford bull, the offspring would be the result of a three breed cross — $\frac{1}{4}$ Angus, $\frac{1}{4}$ Brahman, and $\frac{1}{2}$ Hereford.

Rotational Breeding

There are several variations of rotational breeding, and increasing levels of complexity with each. Rotational breeding systems are much more involved than the two- and three-breed cross systems, and require diligent recordkeeping. A rotational system of breeding increases the genetic diversity by using different breeds of males, depending on the breeding system cycle.

Summary

The two primary breeding systems of livestock are straightbreeding and crossbreeding. The kind of system producers use depends on their particular goals.

Purebred animals are either registered or are eligible for registration with a breed association. Purebred animals tend to be genetically homozygous. Purebred breeders supply seedstock animals for commercial producers.

Purebred registries govern the registration of purebred animals. Purebred registries and breed associations have specific qualifications that an animal must meet in order to be registered. Inbreeding increases the genetic purity of an animal breed, but generally reduces the overall performance of an animal. Both undesirable and desirable traits become more

visible with inbreeding. Inbreeding requires a careful selection and culling process by the producer.

Straightbreeding methods include purebred breeding, inbreeding, and outcrossing. Inbreeding is generally not recommended except in controlled situations. Outcrossing is a way to combine the most desirable traits from different families. Outcrossing provides dominant traits that hide undesirable traits in a breeding program. Grading up is a good way for commercial producers to improve grade herds of livestock.

Crossbreeding is the mating of animals from two different breeds. Crossbreeding is most often practiced by commercial animal producers to achieve the benefits of hybrid vigor. Almost all commercial cattle, swine, and poultry are crossbred. Animals from carefully controlled crossbred systems may outperform purebreds by up to 25 percent.

Crossbreeding systems range from a simple two-breed cross to complex rotational systems. Rotational cross systems are the most complex, requiring careful management and diligent recordkeeping.

Quick Facts

- The number and quality of offspring is a direct result of the breeding system and quality of the breeding stock used.
- Breeding systems can be divided into two basic categories: straightbreeding and crossbreeding.
- Mating animals of the same breed and the same genetic background is called straightbreeding, while mating animals of different breeds is called crossbreeding.
- The breeding system used depends on the producer's particular goals.
- A purebred animal is an animal that exhibits the preferred characteristics of the breed due to generations of unmixed breeding.
- There is a tendency for purebred animals to be genetically homozygous, which means that all of the animals of that breed possess basically the same genetic makeup.
- Purebred animals are not necessarily better than crossbred animals.
- The purebred business is a specialized sector of animal production.
- Seedstock are animals held for breeding to produce offspring for market.
- Purebred seedstock animals may be supplied through females, males, semen, or embryos.
- Purebred registries or breed associations handle the recordkeeping (registration) of purebred animals.

- Inbreeding refers to the mating of related animals.
- Inbreeding is generally not used in commercial animal production.
- Types of inbreeding include close-breeding and linebreeding; the method chosen would depend on how closely related the animals being bred are to each other.
- Outcrossing is a type of straight-breeding that is commonly used by purebred breeders to introduce new genetics.
- Grading up is the mating of purebred sires to grade females.
- Grading up is a good way to improve the quality of the animals within the herd.
- Grading up can be done economically with the use of artificial insemination (AI).
- Crossbreeding ranges from simple to complex.
- Crossbreeding is the mating of two animals from different breeds.
- The offspring from crossbreeding are hybrids.
- The offspring from crossbreeding programs exhibit hybrid vigor or heterosis.
- Heterosis is measured by the superiority of the offspring over the parents.
- Crossbred animals generally perform better, sometimes up to 25 percent better, than purebreds.
- Almost all commercial cattle, swine, and poultry in the United States are crossbred.
- The variations of crossbreeding are: two-breed crosses, three-breed crosses, and rotational breeding.
- The two-breed cross is the simplest type of crossbreeding system.
- A three-breed cross is a breeding system that combines three purebred animal breeds.
- There are several variations of rotational breeding and increasing levels of complexity with each.
- Rotational breeding systems are much more involved than two- and three-breed cross systems, and require good recordkeeping and management.

Student Learning Activities

1. Prepare a written report on one type of breeding system.
2. Crossbred dogs are becoming very popular. Research crossbred dog breeds such as the Labradoodle and prepare a written and/or oral report.
3. Prepare a chart of the advantages and disadvantages of each breeding system.

4. Visit or call a local producer and discuss the type of breeding system used in their operation and why.
5. Research one purebred registry or association. List the requirements necessary for an animal to be registered in this association.

Discussion Questions

1. Discuss each of the major breeding systems.
2. What are the characteristics of the purebred breeding industry?
3. Explain how some breeding systems limit the gene pool.
4. What is grading up and why would a producer choose to use this system?
5. Why is crossbreeding used in breeding programs?

Review Questions

True/False

1. Crossbreeding can improve feed efficiency and carcass traits of offspring.
2. A two-breed cross is the simplest crossbreeding system.
3. Purebred animals usually outperform crossbreds.
4. Crossbred animals are generally healthier than purebreds.
5. Breeding grade cattle to a purebred bull is a good way to improve the genetics of the herd.

Multiple Choice

1. A _____ animal is one that is of a particular breed.
 - a. crossbred
 - b. purebred
 - c. linebred
 - d. all the above
2. What is a common disqualification in rules for registering animals in a breed association?
 - a. weight
 - b. size
 - c. color markings
 - d. eyes

3. Quarter horses that have more than 1 inch diameter of white can be registered with the _____.
 - a. American Pinto Association
 - b. American Palomino Association
 - c. American Appaloosa Association
 - d. American Paint Horse Association
4. _____ cattle carry distinctive characteristics of the breed.
 - a. Grade
 - b. Two-cross
 - c. Purebred
 - d. Commercial
5. It is more important to have a purebred _____ than a purebred _____.
 - a. bull, cow
 - b. cow, bull
 - c. heifer, steer
 - d. steer, heifer

Completion

1. _____ and _____ are two basic systems for breeding livestock.
2. _____ is mating animals from two different lines of breeds within a breed.
3. A _____ is the offspring of two animals from different breeds.
4. _____ is the mating of two closely related animals, such as half-sister to half-brother.
5. _____ is a measure of the superiority of an offspring over its parents.

Short Answer

1. Why are crossbred animals generally better than purebreds?
2. Why is it important to select animals with desired traits when crossbreeding?
3. If a female dog that is $\frac{1}{2}$ Labrador and $\frac{1}{2}$ Poodle is bred to a Terrier, what percent of the offspring's genetics would be from each of the three breeds involved?
4. Why are purebred breeders important to the livestock industry?
5. Why are rotational crosses generally more complex than other breeding systems?



Section 4

BEEF CATTLE

CHAPTER 10 Beef Cattle Production

CHAPTER 11 Beef Cattle Management

CHAPTER 12 Selecting and Judging Beef Cattle

CHAPTER 13 Fitting and Showing Beef Cattle

FFA AND 4-H CONNECTION



The following is a partial list of activities in which a student may participate using knowledge obtained in a beef cattle program. Students should consult local and state youth organization leaders to determine which livestock-related programs are available in their area.

- Agricultural Marketing
- Agricultural Sales
- Agriscience Fair
- Animal Nutrition
- Food Science and Technology
- Livestock Evaluation
- Livestock Shows
- Meats Evaluation and Technology

Proficiency Awards (FFA)

- Diversified Agricultural Production
- Diversified Livestock Production
- Beef Production
- Specialty Animal Production
- Veterinary Medicine





CHAPTER 10

Beef Cattle Production

OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe characteristics of the beef industry.
- Explain the types of beef cattle operations.
- Categorize the breeds of beef cattle.
- Identify the common breeds of beef cattle.
- Select breeds of beef cattle for specific operations and climatic conditions.

KEY TERMS

domestic	fed cattle	disposition
per capita	cull	conformation
marbling	breed	withers
yield grade	<i>Bos taurus</i>	scur
hybrid vigor	dewlap	sheath
heterosis	<i>Bos indicus</i>	herdbook
commercial cattle	pedigree	performance
feedlot	polled	pedigree
finished cattle	dun	

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Beef	Boeuf	Rindfleisch	Manzo	El Carne de Res
Heredity	Hérédité	Vererbung	Eredità	La Herencia
Registered	Inscrit	Eingetragen	Registrato	Registrado
Composite	Composite	Composite	Composito	Compuesto
Continental	Continental	Kontinental	Continentale	Continental
British	Britannique	Briten	Britannico	Británico
Maternal	Maternel	Mütterliche	Materno	Materno
Paternal	Paternel	Väterlich	Paterno	Paterno

Overview of the Beef Industry

Beef production in the United States is a highly efficient industry. The United States produces nearly 25 percent of the world's beef supply even though it only has 10 percent of the world's cattle. The beef cattle industry is the single largest segment of American agriculture. In the United States, 38 percent of total income from all livestock and poultry comes from the beef industry.

Most beef consumed in the United States is **domestically** produced. Exportation of beef varies by year, but averages about 5.75 percent of total U.S. production (Figure 10-1). However, beef imports

domestic

born and raised within the United States

FIGURE 10-1

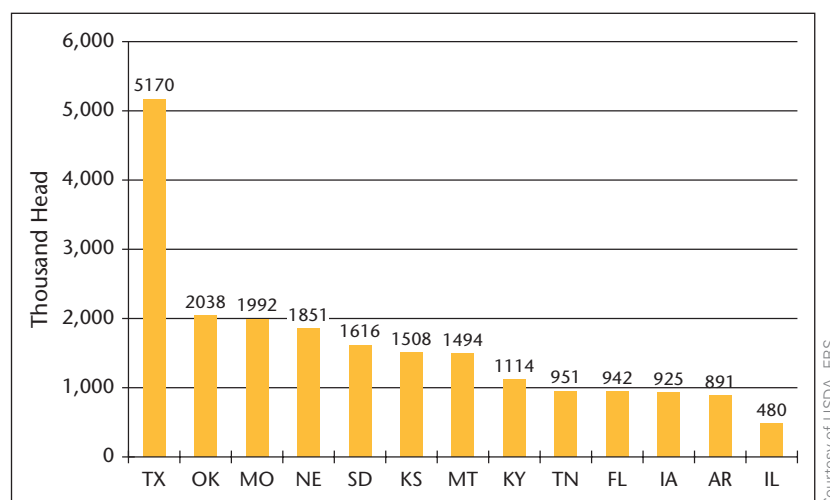
U.S. beef exports vary by year, but average 5.75 percent of total production.



Courtesy of USDA

FIGURE 10-2

The top states for beef production (2009).



average 9 percent. These statistics show that the United States does not produce as much beef as it consumes.

Every state in the United States produces beef cattle. Figure 10-2 shows the top beef-producing states. Texas is by far the leading state in beef production, followed by Oklahoma, Missouri, and Nebraska.

Beef has always been a high demand meat product in the United States. Recent trends, however, have not always been favorable to the industry. Health concerns, including excess cholesterol and fat consumption, and Bovine Spongiform Encephalopathy (BSE) or “Mad Cow Disease,” have adversely affected the image and consumption of beef. Producers of beef have responded to health concerns by producing beef cattle that have a leaner, less fatty carcass. The USDA and cattle industry have been aggressive in detecting and preventing the transmission of BSE. Only three cases of BSE had been reported in the United States through 2009.

Factors Affecting Demand and Consumption of Beef

There are various factors that affect demand and consumption of beef:

- ◀ the supply of beef
- ◀ the number of consumers
- ◀ the price of beef

- ◀ the income of the consumers
- ◀ the dietary trends of consumers

Supply of Beef When the supply of beef increases, the price of beef will go down if all other factors remain the same. Producers often make production decisions based on USDA reports of cattle numbers being produced and the projected supply and demand of beef.

Number of Consumers As the diversity of the United States changes, so does the consumer base for beef (Table 10-1). The relative ease of preparation of ground beef dishes was thought to contribute greatly to the consumption totals. While trends for a more diverse meat selection have been growing, some households are content with the relatively low cost and fast preparation of beef.

Price of Beef The price of beef continually fluctuates, depending on demand from domestic consumers and export demand. According to the USDA Economic Research Service (ERS), the average price of beef per pound was \$3.48 in 2001 and \$3.94 per pound in 2009.

Income of Consumers Generally, people purchase higher quality cuts of beef, such as steak, when their income levels increase. However, over 50 percent of beef is consumed as ground beef, a much less expensive product purchased in greater quantity by

TABLE 10-1

Consumption of Beef by Ethnic Groups

Race/Ethnicity	Pounds Consumed per Capita
White, non-Hispanic	64.50
Black, non-Hispanic	77.21
Hispanic	68.51
Other Races	62.42

Source: U.S. Department of Agriculture (USDA), Economic Research Service (ERS).



©iStockphoto/Ron Tietz 2000

FIGURE 10-3

Consumers tend to purchase more expensive cuts of beef, especially steak, as income rises.

per capita
per person

marbling
the amount of fat intermingled
with the muscle fibers

lower income families. The consumption for low income households was on average 72 pounds of beef yearly—more than the middle- or high-income consumers by about 4 pounds per capita (Figure 10-3).

Dietary Trends and Consumption Changes in a person's meat preferences could be a result of changes in dietary choices. In years past, consumer perception has been that beef is high in cholesterol and fat. Consumers are concerned about their health, and view excess cholesterol and fat as a health hazard.




In recent years, consumption of beef has leveled off to around 66 pounds **per capita** per year. Beef consumed per person is expected to decline slightly in the next few years. Producers are sensitive to these health concerns, and have been improving the carcasses of the beef being sold by reducing the cholesterol and fat content. Overall, the total demand for beef is expected to remain constant or increase slightly.

Carcass Quality and Yield

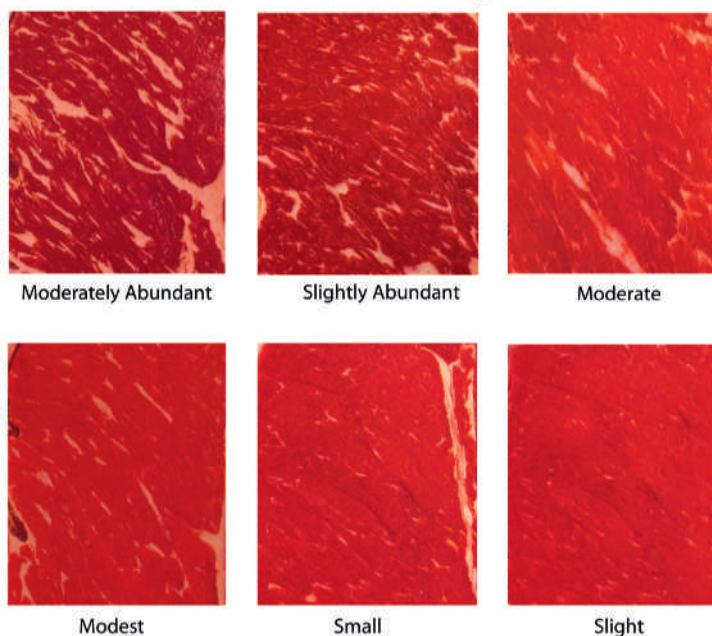
When producing cattle for harvest, producers hope to produce a carcass that will grade high according to the United States Department of Agriculture (USDA) grading standards. Quality grades are the prediction of the eating quality of the product. Quality grades are determined by the age of the animal and the amount of **marbling**. Producing a market animal with too little or too much fat is not desirable. The USDA sets carcass standards to grade the carcass at market (Figure 10-4).

While meat inspection by the USDA is mandatory and paid for with taxpayer money, grading is voluntary and paid for by the processing plant. The main cuts of beef used in grocery stores and other retail outlets are Choice and Select. The lower grades of beef are made into ground beef or used in processed meat products. Prime cuts, mainly steaks, are not usually sold in the supermarket, but instead marketed through higher-end steakhouses.

USDA Quality Grades of Beef

Quality Grade	Description	Marbling Scores
Prime 	Prime has the greatest degree of marbling. In the U.S. about 3% of beef is graded prime. The animal must be less than 42 months of age. Sold in fine restaurants and select meat markets.	Abundant Moderately Abundant Slightly Abundant
Choice 	Choice beef has less marbling than Prime, but is still of high quality. It is the most common quality grade sold in supermarkets. Most beef produced from animals up to 42 months of age is graded Choice.	Moderate Modest Small
Select 	Select is a lower grade than Prime or Choice. It is leaner, but often not as tender, juicy, or flavorful as higher grades. Select is limited to animals under 30 months of age. It is usually the lowest grade sold in supermarkets.	Slight
Standard	Beef graded Standard has limited marbling and must be from animals less than 42 months old. It is usually not sold in supermarkets. Standard beef is often sold as ungraded or store brand beef.	Small to Practically Devoid, depending on age
Commercial	The Commercial grade is restricted to beef from cattle over 42 months old. Commercial beef is not usually sold in supermarkets. It lacks the tenderness of higher grades. Often sold as ungraded or store brand beef.	Marbling ranges from Small to higher scores, depending on age
Utility	Utility beef is mostly derived from animals over 42 months of age. It may be tough, even when cooked properly. Utility beef is seldom sold at retail. It is often used to make ground beef and processed products.	Marbling ranges from Practically Devoid to Moderate, depending on age
Cutter	Beef graded as Cutter is from animals over 42 months of age. It is often used to make ground beef and processed products. Beef graded as Cutter is not sold in supermarkets as retail beef cuts.	Slight or lower
Canner	Canner is the lowest quality grade. It includes only beef that is inferior to the minimum requirements for the grade of Cutter. It is used to make ground beef and processed products.	N/A

Selected USDA Marbling Scores

**FIGURE 10-4**

USDA Grades of Beef.

yield grade

an estimate of the boneless, closely trimmed cuts of beef that can be obtained from the round, loin, rib, and chuck

The **yield grade** is an estimate of the boneless, closely trimmed retail cuts that can be obtained from the round, loin, rib, and chuck. Yield grades are expressed as a number, with 1 being the most desirable, trim cuts and 5 being the least desirable, excessively fatty cuts. The grader uses a number of factors to determine yield grade including carcass weight, internal fat of the kidney, pelvis and heart, the size of the rib eye, and the amount of backfat on the carcass.

Beef Cattle Production Operations

There are four main types of beef cattle production operations: purebred breeder, cow-calf, stocker, and feedlot. Most beef producers specialize in one of these operations, but they sometimes combine one or more of the four types.

Purebred/Breeder Operations

Purebred breeder operations supply bulls (males) and heifers (females) as breeding stock, sometimes called seedstock, for cow-calf operations (Figure 10-5). The goal of purebred breeder operations is to improve the



FIGURE 10-5

Purebred breeders work to improve the genetics of the breed. They help supply quality genetics to commercial producers.

Courtesy of Derek Frenzel

hybrid vigor or **heterosis**

the improved characteristics of an animal produced by breeding two different breeds of animal; the superior characteristics of the offspring compared to its parents

commercial cattle

cattle raised for the purpose of producing meat

genetics of the beef breed for use in commercial beef herds. Seedstock producers are known for producing purebreds but may also crossbreed stock. In crossbreeding, two animals of different breeds are mated to obtain the benefits of **hybrid vigor**, also known as **heterosis**. Cow-calf producers may obtain purebred or crossbred stock to improve their herd. Almost all **commercial cattle** are crossbreeds, whether crossbred by the seedstock producer or the cow-calf producer.

Cow-Calf Operations

The primary objective of cow-calf operations is to produce calves (Figure 10-6). Cow-calf production can be on a large or small scale, and is ideal for part-time farmers. Cow-calf operations are found across the United States, but a high percentage is found in the South and Western states. Calves are sold shortly after weaning, or may be held longer depending on the markets and the producer's objectives. Calves are generally sold to stocker operations, but some calves may go directly to a feedlot. Good quality pasture is needed so that the cows can be adequately maintained with little or no supplemental feeding. Cows and their calves are fed most economically on pasture. Each cow-calf is given one or more acres, depending on conditions.

FIGURE 10-6

One goal of a cow-calf operation is to produce a 100 percent calf crop—one calf from each cow every year.



Courtesy of American Red Angus Association

Cows are usually bred so that they calve in the late winter or spring, and the calves are mostly weaned in the fall and sold to stocker operations. The main objective of a cow-calf producer is to produce a calf to sell from every cow each year. A 100 percent calf crop is the goal, but this is difficult to achieve.

Stocker Operations

Stocker operations, also called backgrounding operations, take calves at or shortly after weaning and raise them to their near-mature body size. In stocker operations, weaned calves are placed on pasture and other forages until they are large enough in body size for the feedlot. Stocker operations feed little or no grain. The calves will generally gain from 100 to 400 pounds while maturing in body size. Weight gain is emphasized primarily in the growth of the frame and muscle, and not on fattening.

feedlot

a type of farm in which cattle are grouped in lots and fed to fatten them for harvest

finished cattle or fed cattle

cattle raised to appropriate weight for harvest

Feedlot Operations

Cattle feeders or **feedlot** operations focus on feeding animals to market weight in the shortest time possible (Figure 10-7). Animals ready for harvest are called **finished cattle** or **fed cattle**.

In feedlot operations, feeder calves are grown from a starting weight of about 800 pounds to a

FIGURE 10-7

In feedlots, cattle are fed a diet of concentrated feed, usually corn-based, in order to gain weight for harvest.



Courtesy of USDA

did you know?

Cattle outnumber humans in nine states in the United States. They include Idaho, Iowa, Kansas, Montana, Nebraska, North Dakota, South Dakota, Oklahoma, and Wyoming.

harvest weight of 1,100 to 1,400 pounds. Most feedlot operations are in the interior plains region, and about 75 percent of all fed cattle are found in Texas, Kansas, Nebraska, Colorado, and Oklahoma.

Feedlot operations require a ready source of high energy feeds such as corn. It is cheaper to ship calves to areas where grain is plentiful rather than shipping the grain to areas of the country where the calves are raised. Feedlots are usually located in less populated areas with access to processing plants.

Although most feeding operations are relatively small, some feedlots house over 100,000 head of cattle. Smaller feedlots with less than 1,000 head of cattle make up about 96 percent of total operations, accounting for 18 percent of total fed cattle each year. Large feedlots with more than 32,000 head of cattle, however, account for less than 1 percent of total operations but make up nearly 35 percent of the total fed cattle sold.

Introduction to Breeds of Beef

Breeds are developed by selecting animals with desired traits and **culling** animals with undesirable traits. After many generations of breeding and selecting for specific traits, the offspring have very similar characteristics, resulting in a **breed**. In the United States, many new breeds have been developed during the twentieth century by crossing some of the existing breeds. Brahman cattle, for example, were developed by crossing many Zebu breeds.

Over 50 breeds of cattle are common in the United States, although only a few are important commercially. Some of the breeds with the highest breed registrations and production in the United States include Angus, Limousin, Simmental, Hereford, Polled Hereford, and Charolais. Europe is the origin of many of the modern breeds of beef cattle such as Angus and Hereford.

cull

to remove an undesirable animal

breed

a group of animals with similar traits and characteristics; developed from the same bloodlines

Bos taurus

a species of beef cattle with European origins that thrive in temperate regions

dewlap

skin under the throat

Bos indicus

a species of beef cattle originating in tropical areas which are heat tolerant and disease and insect resistant; also known as Zebu

Classification of Breeds

All breeds can be classified as either *Bos taurus* or *Bos indicus* cattle. ***Bos taurus*** cattle are generally of European origin and thrive in temperate regions. They have short necks with **dewlaps**, or loose skin under the throat, and have short hair and long tails (Figure 10-8). ***Bos indicus*** cattle, also known as Zebu or “humped cattle,” have a characteristic hump over the shoulders, drooping ears, and larger dewlaps (Figure 10-9). This species originated in tropical countries. Zebu cattle are known for being heat tolerant, and disease and insect resistant.

FIGURE 10-8

A polled Hereford heifer is a classic example of a *Bos taurus* breed. Notice the short neck which is a characteristic of *Bos taurus*.



Delmar/Cengage Learning

FIGURE 10-9

A Brahman cow is an example of a *Bos indicus* breed. Note the extra skin (dewlap) under the neck and the hump on the back.



©Stockphoto/Sam Haddow



Science Connection

Bos indicus breeds have oily skin, which helps with insect control. The oil from the skin of *Bos indicus* helps block the air holes through which insects breathe. The thin skin and light hair coat of *Bos indicus* makes them heat tolerant. The loose skin of *Bos indicus* provides more area for heat dispersal and cooling. Zebu breeds thrive in the southern United States, but cannot tolerate the cold climate of the northern United States.



Geography Connection

Bos taurus originated mainly in Europe. *Bos indicus* (Zebu) originated in tropical areas, especially India. *Bos taurus* are most common in the United States and can be found throughout the world due to European migration.

Once cattle have been identified as either *Bos indicus* or *Bos taurus*, they can then be categorized as British breeds, Continental breeds, or Composite breeds.

British Breeds British breeds are those breeds that were developed in the British Isles. Two of the best known British breeds are Angus and Hereford. British breeds are known for high fertility, calving ease, and high meat quality.

Continental Breeds Continental breeds are usually larger at maturity, and produce more marketable products. These breeds originated in continental Europe. Examples of the continental breeds are Limousin and Charolais.

Composite Breeds Composite breeds are developed by crossing two or more breeds to increase or retain superior characteristics of the offspring.

TABLE 10-2

Selected Beef Cattle Breeds by Species and Type

Beef Breed	<i>Bos taurus</i>	<i>Bos indicus</i>	British	Continental	Composite
Angus	X		X		
Beefmaster	X	X			X
Braford	X	X			X
Brahman		X			X
Brangus	X	X			X
Charbray	X	X			X
Chianina	X			X	
Devon	X		X		
Galloway	X		X		
Gelbvieh	X			X	
Hereford	X		X		
Limousin	X			X	
Pinzgauer	X			X	
Salers	X			X	
Santa Gertrudis	X	X			X
Shorthorn	X		X		
Simmental	X			X	

over its parents. One example of a composite breed is the Santa Gertrudis, which combines the breeding of a Brahman bull with a Shorthorn cow. The resulting breed is maintained like a purebred breed. Table 10-2 relates the various species with their breeds.



Geography Connection

British breeds were developed in the British Isles. The British Isles include Great Britain, Ireland, and many small islands located on the northwestern coast of continental Europe. Today, the term “Britain and Ireland” is becoming the preferred term over “British Isles.” The British breed names Angus and Hereford come from the names of geographical regions. Angus is the name of a former county in northeast Scotland, and Hereford is a town in west-central England.

pedigree

a record of the breed lines that ensures the standard and quality of the breed

Selecting a Breed

In the cattle industry, breed selection is a major decision for producers. This decision will define the genetics of the herd, and to a large degree, determine the profitability of the enterprise. Every breed has strong and weak traits, and there is no one breed that has all the best traits. The selection of breeding stock should be based on good breeding practices and scientific data rather than **pedigree** or showing winnings. Many factors must be considered in breed selection, such as climate, grazing conditions, market demand, calving ease, adaptability, meat quality and yield, and milking ability.

Cattle Terminology	
Common Term	Cattle Term
Genus	Bos
Group	Herd
Newborn	Calf
Young Intact Male	Bull Calf
Young Female	Heifer Calf
Mature Intact Male	Bull
Mature Female	Cow
Castrated Male	Steer
Giving Birth	Calving
Female that has not yet given birth to a calf	Heifer

Characteristics of the Breeds

Breeds are determined by their unique characteristics. Some breeds may thrive better in warmer climates, others may produce a better quality of meat, and some may have better reproductive capacities.

Angus

polled
an animal naturally lacking horns

Aberdeen-Angus is the official name of the Angus breed. The Angus breed has British origins, and for many years has been the leader in registered numbers over all other breeds in the United States. Aberdeen-Angus have a smooth black coat of hair and are **polled** (Figure 10-10). The American Angus Association registers only black calves. Some Angus carry a recessive gene for a red hair coat. Occasionally, red calves are born to black parents. The red offspring cannot be registered with the American Angus Association.

Angus are known for producing well-marbled meat, which makes their carcasses desirable and of high quality. It is the most popular beef breed in the United States, leading all breeds in the number of registered beef cattle. Registered Angus can be a variety of sizes, from small (800–1200 pounds, or 363–544 kg) to very large (1800–2100 pounds, or 816–953 kg), depending on the genetics.

Angus	
Origin	Scotland
Brought to U.S.	1873 by George Grant
Color	Black



FIGURE 10-10
Angus bull.

Courtesy of American Angus Association

FIGURE 10-11

Beefmaster bull.



Courtesy of Derek Frenzel

Beefmaster

In 1931, the Beefmaster breed was developed in Texas (Figure 10-11). This breed resulted from crosses between Herefords, Shorthorns, and Brahmans. Beefmaster cattle are registered with Beefmaster Breeders United. Registered cattle in this breed are either descendants from the original herd, or are from crossbreeding non-registered stock with registered stock.

The breed has a variety of colors, with reds and **duns** being most common. Beefmaster cattle can be horned or polled, and are usually selected for fertility, hardiness, and milk production.

dun

a dull brownish color

Beefmaster	
Origin	Texas
Color	Various; mostly red and duns

Brahman

The Brahman breed was developed from several strains of Zebu cattle that were bred to British breeds. Brahmans are the basis for a number of newer beef

FIGURE 10-12
Brahman bull.



Courtesy of the American Brahman Breeders Association

disposition
the manner in which the animal acts
or behaves

breeds. The American Brahman Breeders Association was formed in 1924. Along with their characteristic hump over the shoulders, Brahmans have loose skin, a large dewlap, and big drooping ears (Figure 10-12). Brahmans have a very high heat tolerance and are resistant to diseases and insects. They are good mothers and have excellent foraging ability on poor range. A mature cow weighs from 1,000 to 1,400 pounds (454–635 kg), and mature bulls weigh 1,600 to 2,200 pounds (726–998 kg). Brahmans gain weight rapidly and produce quality carcasses. They tend to have an unpredictable **disposition**.

Brahman	
Origin	Southwestern United States
Color	Light gray or red, to almost black

Brangus

The Brangus breed is a cross between Brahman and Angus cattle (Figure 10-13). Crosses of these cattle were made as early as 1912. Only animals registered

FIGURE 10-13

Red Brangus bull.



Courtesy of the American Red Brangus Association

conformation

the shape or dimensions of the animal

with the breed association can be called Brangus because Brangus is a registered trademark. The Brangus breed is based on a foundation stock that is $\frac{3}{8}$ Brahman and $\frac{5}{8}$ Angus. Brangus are polled and have a black hair coat. All present-day Brangus are descendents of these foundation animals. Brangus cattle are adaptable to different climates, have sound mothering abilities, and fine carcasses. Before being registered, the Brangus breed must go through an inspection to determine **conformation** and breed character. The breed association for Brangus is the International Brangus Breeders Association.

Brangus	
Origin	Louisiana
Color	Solid black

Charolais

One of the oldest French cattle breeds is the Charolais. The King Ranch imported the first Charolais into the United States in 1934. Charolais have a white to light straw-colored coat (Figure 10-14). They are large and very heavily muscled, and are used in many crossbreeding programs. A mature bull weighs around 2,000 to 2,500 pounds (907–1,134 kg) and a mature cow weighs 1,500 to 1,800 pounds (680–816 kg). Most Charolais have



FIGURE 10-14
Young Charolais bull.

horns but some are naturally polled. The Charolais are registered with the American-International Charolais Association.

Charolais	
Origin	France
Brought to U.S.	1934
Color	White to light straw

Chianina

The Chianina (pronounced Key-a-nee-na) originated in Italy (Figure 10-15). It is one of the oldest breeds in the world, and possibly the largest breed in body size. Because of crossbreeding, the Chianina breed can be many different sizes, colors, and types, depending on the cross used. This breed has a high heat tolerance and mild disposition. A mature Chianina bull can be, at the **withers**, 6 feet tall (1.8 m) and weigh as much as 4,000 pounds (1,814 kg). A mature Chianina cow can be, at the withers, 5 feet tall (1.5 m) and weigh as much as 2,400 pounds (1,088 kg).

Chianina are used in crossbreeding programs for a number of reasons. They improve the growth rate of the offspring. Chianina are good foragers and

.....
withers
at the shoulder bone
.....



Courtesy of American-International Charolais Association

FIGURE 10-15

Chianina bull.

did you know?

The heaviest calf born on record is 225 pounds. It was born in Great Britain in 1961 to a British Friesian cow.

mothers. They have a high tolerance for insects and diseases, and are adaptable to cold and hot climates as well as to rough terrain.

Chianina	
Origin	Italy
Brought to U.S. (Semen was imported)	1971
Color	Originally White with Black Switch

Gelbvieh

In 1920, several breeds were used to create the Gelbvieh (pronounced gelp-fee) breed. Gelbvieh cattle have a basic color of red or black but can be gray to light yellow (Figure 10-16). They are medium sized, produce a very acceptable carcass, and have good milking ability.

Gelbvieh	
Origin	Germany
Brought to U.S.	1972
Color	Basic color is red or black



Courtesy of the American Gelbvieh Association

FIGURE 10-16

Gelbvieh bull.



Math Connection

FRACTIONS

Commercial cattle producers take advantage of heterosis—the increased growth and performance attained by cross-breeding cattle. In the trade, the part of a certain breed in a crossbred animal is expressed by fractions. For example, a bull with a purebred Angus sire and purebred Simmental dam would be $\frac{1}{2}$ Angus and $\frac{1}{2}$ Simmental. Further crosses get more involved and a working knowledge of fractions is essential.

Example: Suppose a Simmental-Angus bull ($\frac{1}{2}$ Simmental and $\frac{1}{2}$ Angus) was bred with a Gelbvieh cow. Then the offspring would be $\frac{1}{4}$ Simmental, $\frac{1}{4}$ Angus, and $\frac{1}{2}$ Gelbvieh.

Problem: What would the lineage, in fractions, be if the above offspring were bred with an Angus bull?

Hereford and Polled Hereford

The Hereford breed originated in Hereford shire, England. In 1742, a red bull with a white face was brought into the breeding line, giving the breed its characteristic markings. Registration for Herefords started with the American Hereford Association in 1881. Some Herefords are horned (Figure 10-17) and some are polled. They have white on their heads, belly, legs, and switch (the bushy tip of the tail). A mature cow weighs about 1,200 pounds (544 kg)

FIGURE 10-17

Hereford bull.



Courtesy of USDA

and a mature bull weighs around 1,840 pounds (834 kg). Herefords are known for being docile and easy to handle. In the United States, Herefords are well-adapted to the western cattle-raising regions. They are hardy animals and produce more calves under difficult conditions than other breeds. When crossbred, the white face and color pattern tend to be dominant. Polled Herefords can be registered with the American Hereford Association; the only distinction made on the registration papers is the “P” for polled animal.

Hereford	
Origin	Hereford shire County, England
Brought to U.S.	1817 by Henry Clay of Kentucky
Color	White faces, red bodies, white markings on belly, chest, and legs

Limousin

Limousin cattle received their name from a province in west-central France where they originated about 7,000 years ago. The Limousin Breed Association was started in 1886. In 1968, semen was imported into the United States from Canada, and



FIGURE 10-18

Limousin bull.

scur

a growth that sometimes occurs after horn removal, at the same place where the horn was located

with this, the North American Limousin Foundation started registering cattle. Full-blood and purebred Limousins can be polled, **scurred**, or horned. The head is short and small with a broad forehead and short neck (Figure 10-18). The weight of a mature female is around 1,200 to 1,400 pounds (544–635 kg), and mature bulls weigh 2,000 to 2,200 pounds (907–998 kg).

Limousin	
Origin	France
Brought to U.S.	1968
Color	Light red hair, lighter circle around the eye Can be red or black

Maine-Anjou

The Maine-Anjou breed was originally used as work animals. This breed is a result of crossing English Shorthorns and French Mancelle cows. Today’s Maine-Anjou is considered an excellent beef producer. Through selective breeding, good milk and beef production traits have been developed. This breed was brought to the United States in the form of semen from Canada. The first of this type of cattle

FIGURE 10-19

Maine-Anjou bull.



Courtesy of the Maine-Anjou Association

were born in the United States and were registered with the American Maine-Anjou Association in 1972. The Maine-Anjou has lightly pigmented skin and medium sized horns (Figure 10-19). They are relatively easy to handle and docile, and they have a fast growth rate and well-marbled carcass. A mature male usually weighs around 2,750 pounds (1,247 kg) and a mature female usually weighs around 1500–1900 pounds (680–862 kg).

Maine-Anjou	
Origin	France 1840s
Brought to U.S.	1970
Color	May be red, black, roan or spotted

Red Angus

Red Angus herds were developed by breeding red animals from the Black Angus breed. Red is a recessive gene in the Black Angus. The offspring of the red Angus are always red (Figure 10-20). Red Angus were not allowed to be registered with Black Angus after 1917. In 1954, the Red Angus Association of America was formed. Red Angus are more tolerant of the heat than Black Angus because their red coat absorbs less light than a black coat.



FIGURE 10-20
Red Angus cow and calves.

Red Angus	
Origin	United States
Year	1954 – breed registration started
Color	Red

Santa Gertrudis

The Santa Gertrudis breed was a product of crosses between Brahman bulls and Shorthorn cattle on the King Ranch in Kingsville, Texas (Figure 10-21). Crossbreeding began in 1910 until the Santa Gertrudis breed was established as 3/8ths Brahman and 5/8ths Shorthorn in 1940. Every present-day Santa Gertrudis is a descendant of the original bull, Monkey, who was used to start the breed. The association has a Standard of Excellence, and animals that meet the standards are branded with an “S” and certified purebred. Santa Gertrudis can be polled or horned and both are eligible for registration. They are resistant to diseases and insects, and are efficient in the feedlot. They have loose skin on their necks and a navel flap or **sheath**. They have short hair in warm climates and grow long hair in cold climates. Santa Gertrudis also produce a desirable carcass with little wasted fat.

sheath
navel flap, a protective covering
of a part of an animal

FIGURE 10-21

Santa Gertrudis cow and calf.



Courtesy of Santa Gertrudis Breeders International

Santa Gertrudis

Origin	Texas
Year Originated	About 1910
Color	Cherry Red

herdbook

a recognized, official record of the ancestry of a purebred animal which is kept by the particular breed association

Shorthorn

The Shorthorn breed was originally a dual-purpose breed used for milk and meat production (Figure 10-22). In 1822, The Coates Herdbook was established for Shorthorns as the first cattle **herdbook** with guidelines that all other herdbooks would adopt and follow. Shorthorns came to the United States between 1820 and 1850. This breed has short horns that curve inward, and are known for being easy to handle and to have a good disposition. They are adaptable to many climates, have good milking ability, and produce a desirable carcass. A mature cow can weigh up to 1,500 pounds (680 kg) and a mature bull can weigh up to 2,400 pounds (1,088 kg). There is also a Polled Shorthorn which originated in Minnesota in 1881. Other than being naturally polled, they are the same as the Shorthorn. Both can be registered with the American Shorthorn Association.

FIGURE 10-22
Shorthorn cow.



Courtesy of the American Shorthorn Association

Shorthorn	
Origin	England
Brought to U.S.	1783
Color	Red, white, or roan

Simmental

The Simmental breed originated in Switzerland around the Middle Ages. About 50 percent of the cattle in Switzerland are Simmentals, and they are the most popular breed in Europe. The original breed requirements included a **performance pedigree** for milking ability and physical appearance, and have since extended to desirable carcasses. After the breed was brought to the United States, the American Simmental Association was organized. The American Simmental Association has no color requirement, but all animals must have a performance pedigree to be eligible for registration. Simmentals are horned, large bodied animals, and known to have a calm disposition (Figure 10-23). Mature cows weigh around 1,450 to 1,800 pounds (658–816 kg), while mature bulls weigh around 2,300 to 2,600 pounds (1,043–1,179 kg).

performance pedigree
a tool that helps beef cattle producers determine which animals to keep and breed. This performance pedigree analyzes how much of the particular animal’s genetics will be passed to subsequent generations

Simmental	
Origin	Switzerland
Brought to U.S.	1969
Color	White to light straw faces; red to dark red body

FIGURE 10-23
Simmental bull.



Texas Longhorn

The Texas Longhorn originated from Spanish Andalusian cattle brought to Santa Domingo by Columbus on his second voyage in 1493, and descendants were later brought to Texas. In the late 1800s, Longhorns began to be replaced by European breeds. Longhorns were almost extinct by 1900. A group of concerned cattlemen started the Texas Longhorn Breeders Association of America in 1964. The Association was organized to maintain the breed registry, promote the breed, and preserve purity.

There has been renewed interest to set up breeding programs with Texas Longhorns that will produce cattle with leaner meat and lower cholesterol levels. Longhorns are known for their characteristic horns that curve upward and spread over 4 feet or more wide. They have large heads, long legs, and are tall in their shoulders (Figure 10-24). They are well-adapted to harsh conditions and known for being hardy.

Texas Longhorn	
Origin	Texas
Color	Many shades and colorings



Courtesy of Cole Dowden, Texas Longhorn Breeders Association of America

FIGURE 10-24

Texas Longhorn cattle.

did you know?

The University of Texas mascot is the Texas Longhorn. The University adopted a real Texas Longhorn steer in 1916 as their official mascot. Their mascot, named Bevo, is often called the “toughest-looking animal mascot in sports.”

Summary

The beef industry has four basic types of operations: purebred breeders, cow-calf, stocker, and feedlot operations. Each one plays an important role in the industry and has its own characteristics. Breeds were started by the selection and removal of traits to produce a group of animals with specific traits. There are many breeds of cattle with distinct characteristics and traits. Cattle can be assigned to different classes according to origin and genetics. *Bos indicus* and *Bos taurus* are the two species of cattle. Cattle breeds can be categorized further into British, Continental, and Composite breeds. There are more than 50 breeds available in the United States. Selection of a breed for production should be based on region, management, and facilities, as well as genetic and production statistics. Purebred cattle are often crossbred to obtain heterosis, where desirable traits of both parents are displayed in the offspring.

Quick Facts

- The beef cattle production industry is the single largest segment of American agriculture.
- Consumption of beef is affected by beef supply, price, the number of consumers, income of the consumers, and dietary trends.
- The United States produces 25 percent of the world's beef supply with only 10 percent of the world's cattle.
- The four main types of beef production operations are purebred breeders, cow-calf, stocker, and feedlot operations.
- A breed is developed over many generations by selecting animals with desirable traits to keep for breeding, and culling animals with undesirable traits.
- Cattle breeds are one of two species, *Bos taurus* or *Bos indicus*.
- Beef breeds are further classified as British, Continental, or Composite breeds.
- *Bos taurus* are generally of European descent and include the Texas Longhorn, Angus, Shorthorn, Hereford, Simmental, Limousin, Charolais, Gelbvieh, Maine-Anjou, and Chianina.
- *Bos indicus* include the Brahman breed. They are also known as 'humped' cattle. *Bos indicus* originated in tropical areas. They are well-suited to hot and humid climates.
- Many breeds have *Bos indicus* or Brahman influence, including, Brangus, Santa Gertrudis, and Beefmaster.
- Beefmaster, Brahman, Brangus, Red Angus, Santa Gertrudis, and Texas Longhorn breeds were developed in the United States.
- Breeds are maintained by breed associations which require registration and verification of a purebred.

Student Learning Activities

1. Plan a beef cattle farm. Which breeds of beef cattle would be best in your region? Why?
2. Visit a beef cattle operation and interview the producer on his/her selection of cattle.
3. Visit a cattle auction and keep track of which breeds of beef cattle come through the sale. Which breeds seem most popular and bring the highest prices?

4. Study meat packaging labels and compare labels for various meat cuts. What information is found on the labels? What is the nature of beef consumption in your home?
5. Select at least five breeds of beef cattle and prepare an informational page that includes photographs of the breeds. Photos may be obtained from magazines, breed promotional materials, or from the Internet.

Discussion Questions

1. Name and explain three things that affect per capita consumption of beef.
2. Why is selection of a beef breed vitally important to cattle producers?
3. Name and discuss the four types of beef cattle operations.
4. Compare and contrast the two genera of beef cattle (*Bos taurus* and *Bos indicus*).
5. Explain the difference between British, Continental, and Composite beef breeds.

Review Questions

True/False

1. Heterosis is the reason producers crossbreed cattle.
2. *Bos indicus* cattle are well suited for the South and Southwest United States.
3. Breeds of beef cattle are maintained by the United States Department of Agriculture.
4. Bovis is the name of the University of Texas' mascot.
5. Beef cattle production in the United States is the number one agricultural enterprise.

Multiple Choice

1. Which breed is a cross of an English Shorthorn and a French Mancelle?
 - a. Red Angus
 - b. Texas Longhorn
 - c. Maine-Anjou
 - d. Chianina

2. In beef cattle, what does the term 'polled' refer to?
 - a. The height of the cattle
 - b. The presence of horns
 - c. The mannerism of the cattle
 - d. The lack of horns
3. Which breed of cattle originated from crosses of Herefords, Brahmans, and Shorthorns?
 - a. Beefmaster
 - b. Santa Gertrudis
 - c. Brangus
 - d. Chiangus
4. The finishing of cattle on concentrate diets in confined areas is normally referred to as a _____ operation.
 - a. cow-calf
 - b. breeder/stocker
 - c. purebred
 - d. feedlot
5. The _____ is a breed that originated from cattle that Columbus brought to the Americas.
 - a. Santa Gertrudis
 - b. Red Angus
 - c. Texas Longhorn
 - d. Maine-Anjou

Completion

1. The most common grades of beef available at the local supermarket are _____ and _____.
2. *Bos* _____ cattle are more suited for the south and southwest United States.
3. The _____ is the extra skin that hangs from the neck.
4. The _____ skin of *Bos indicus* cattle helps them dissipate heat.
5. The quality grade of beef is determined primarily by the age of the animal and the amount of _____ in the meat.

Short Answer

1. What breeds are known for their humpback appearance?
2. What are the distinguishing characteristics of *Bos indicus* cattle?
3. Describe a cow-calf operation. What are the benefits and drawbacks?
4. What breeds of cattle would be best for the area in which you live? Why?
5. Explain the advantages of crossbreeding cattle.



CHAPTER 11

Beef Cattle Management

OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe systems of cattle feeding.
- Discuss the breeding systems and techniques used in beef cattle.
- Discuss the importance of maintaining healthy beef cattle.
- Describe the facilities needed for beef cattle production.
- Explain marketing options for beef cattle producers.

KEY TERMS

ruminant	embryo transfer	foot-and-mouth disease
palatability	anthrax	shipping fever
legume	bovine	bovine
intensive grazing	spongiform	respiratory
rotational grazing	encephalopathy (BSE)	disease (BRD)
finishing	bovine viral	systemic
body condition score (BCS)	diarrhea virus (BVDV)	insecticide
obese	brucellosis	parasitologist
colostrum	blackleg	squeeze chute
artificial insemination	scours	head gate

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Sale Barn	Vente Grange	Verkauf Scheune	Vendita Fienile	El Granero de Vender
Herd	Troupeau	Herde	Mandria	El rebaño
Pasteurize	Pasteuriser	Pasteurisieren	Pastorizzare	Pasteurizar
Growth	Croissance	Wachstum	Crescita	Crecimiento
Parasite	Parasite	Parasit	Parassita	El parásito
Yield	Rendement	Ausbeute	Rendimento	El Rendimiento

Management of Beef Cattle

Scientific management of beef cattle is important to the efficient and profitable production of beef. While cattle can survive with little care, to be profitable, excellent care must be provided and proper management practices must be followed. Good beef cattle management practices include: feeding, breeding, establishing a health plan, controlling pests and diseases, maintaining proper facilities, and marketing.

Feeding Beef Cattle

Beef cattle are ruminants and can utilize forages that humans cannot. Although the bulk of a beef-producing animal's diet is forage, supplemental grains and proteins are usually fed in the later stages of development before harvest to produce a higher quality carcass.

Kinds of Feed

As with other **ruminants**, the most cost-effective way to feed cattle is on pasture. Pasture and harvested roughages are the base feeds of the cattle industry. Common roughages used for beef cattle

ruminant

a cud-chewing animal with a forestomach that allows fermentation of ingested materials

FIGURE 11-1

Corn silage.



Delmar/Cengage Learning

palatability

appealing to the sense of taste

legume

a family of plants such as soybeans and clovers that, with the aid of symbiotic bacteria, can convert nitrogen from the air into a form of nitrogen in the soil that can be used by plants

intensive or rotational grazing

periodically moving livestock from one section of a pasture to another

include grasses, hay, silage, and other crop residues (Figure 11-1). Roughages vary widely in quality and **palatability**.

Grasses used for pasture or hay include fescue, Bermuda grass, orchard grass, timothy grass, Bahia grass, and Sudan grass. Some **legumes** used for cattle include clover, lespedeza, peanut hay, alfalfa, and soybean hay. Legumes are some of the highest quality feeds. If the quality of the roughage is good, little or no supplementation is needed for cow-calf operations or stocker operations.

On good pastures in some parts of the United States, 1 to 2 acres of pastureland is needed to support each cow. In arid pastures, such as the ones located in the western United States that receive only 7–15 inches of rain per year, it takes many acres to provide adequate feed per cow. **Intensive or rotational grazing** allows grazed sections to regrow. Research has shown that rotational grazing produces more total forage than letting the herd graze in the whole pasture on a continual basis.

Cattle can be fed high-energy feeds such as corn, soybeans, and oats, but the use of these feeds is more costly for producers (Figure 11-2). The use of high-energy, higher cost feeds is usually reserved

FIGURE 11-2

Corn is a high-energy feed. Corn and other grains are usually reserved for feeding cattle in preparation for harvest.



Courtesy of USDA

finishing

the increased feeding of an animal before harvest to increase weight and improve carcass quality

for **finishing** cattle. Finishing is the process of feeding animals prior to harvest so that they make sufficient weight gains for improved carcass quality.

Minerals

Salt, calcium, and phosphorus are the main minerals needed in rations for finishing cattle. Providing free-choice minerals is a good way to provide for the mineral needs of cattle on pasture. A mineral feeder should keep the minerals fresh and protected from the weather (Figure 11-3).

FIGURE 11-3

Cattle should be provided with minerals as a dietary supplement. Minerals can be supplied as a liquid or as a dry mix. A dry mineral feeder should keep minerals fresh and protected from the weather.



Delmar/Cengage Learning

FIGURE 11-4

A growth implant gun used to insert a growth promoter in the ear of feeder cattle.



Delmar/Cengage Learning

Additives and Implants

A number of feed additives and hormones called growth-promoting pharmaceuticals are available for finishing cattle. Growth-promoting pharmaceuticals help animals produce more muscle rather than fat. They also help animals to grow faster and more efficiently. Cattle feeders should check current regulations before using any additive or implant. Label instructions must be carefully followed. Hormone implants are usually implanted into the ear, and they slowly dispense hormones into the bloodstream of feeder cattle over time (Figure 11-4).

Feed Intake

The amount of feed that cattle will consume is related to the energy level of the ration, the weather, feed palatability, feed processing, and the desired degree of finish on the cattle. Beef cattle generally decrease feed intake in hot weather and increase feed intake in cold weather. The ruminant produces a great amount of heat from digestion. Because of this, in hot weather, cattle rest in the shade and have decreased appetites. Animals require a certain level of nutrition to maintain their body weight. In cold weather, their bodies need nutrients to make heat and also maintain body weight, so cattle will eat more in cold weather conditions.

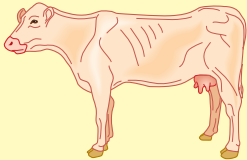
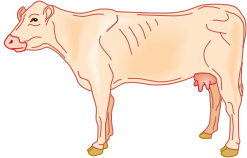
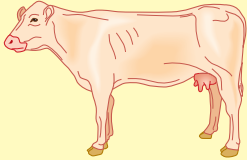
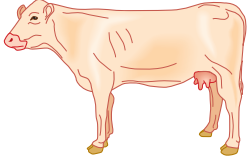
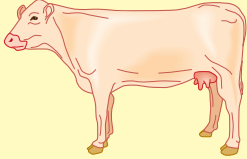
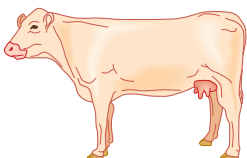
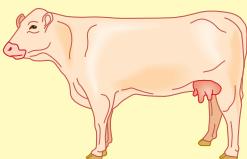
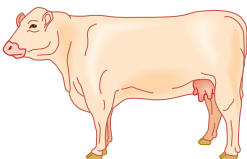
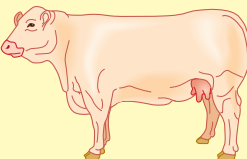
In cow-calf operations, cattle are fed based on their **body condition score (BCS)** (Figure 11-5).

body condition score (BCS)

a numerical scale that describes the overall condition of the animal's body, with one being emaciated and nine being obese

FIGURE 11-5

Body Condition Scoring Chart.

Score	Characteristics	Illustration
1	Severely emaciated, bones projecting through hide; animal is very weak	
2	Emaciated, no fat, tail head and ribs prominent	
3	Very thin, no visible fat, backbone visible, ribs may also be visible	
4	Borderline, some ribs noticeable, some muscle through shoulders and hindquarters, hips and backbone slightly rounded	
5	Moderate, fat cover over ribs, tail head full	
6	Good, slightly rounded in appearance, spongy to the touch, some fat present in brisket	
7	Fat, fleshy, bones not visible, some fat in udder and tail head	
8	Very fat, squared appearance, extreme fat deposits in brisket and throughout ribs, excessive fat in udder, mobility reduced	
9	Obese, very squared appearance, fat visible all over body, extreme fat in udder limits lactation, mobility impaired	

obese

grossly overweight

This score is based on a scale from one to nine. A cow with a body condition score of one would be extremely lean to the point of showing her skeletal frame, and she would be physically weak. A cow with a body condition of nine would be considered **obese**. An ideal body condition score for bulls and cows is five. Rather than weight, reproduction is the objective in a cow-calf operation. Cows that are underweight or overweight are poor breeders.

Breeding Beef Cattle

Breeding management is the most important factor in a profitable cow-calf operation. The objective is to produce a calf from every cow every year (Figure 11-6). While a 100 percent calf crop is ideal, it is rarely achieved for a number of reasons. Some cows do not get bred, or they abort, or the calf does not survive for some reason. Careful management is needed to ensure a high percentage of healthy calves.

The cow herd should be closely observed during the breeding period. Cows should have a body condition score (BCS) of 5–6. Hot weather lowers the conception rate. Conception rate is increased when



FIGURE 11-6

Cows need to be fed enough so that they can maintain their bodies plus provide enough nourishment for their calves.

cows are in good condition and are gaining weight. Producers will often increase the feed or quality of the feed just before the breeding season.

Heifers may be bred at about 15 months of age, but they should be at least 65 percent of their mature weight before breeding. This will help ensure that the heifer is large enough at calving to prevent calving problems. The objective is for heifers to calve at about two years of age.

Calving

Most cow-calf operations breed for spring calves since this is the time of year when pastures grow rapidly. The cows and calves are able to meet their nutritional needs from the readily available and cost-effective pasture. Calving should occur during a 40- to 60-day period for a calf crop that is more uniform in weight and age. Spring calves require less housing and less feed than calves born during other times of the year. When born in the spring, the calves utilize pasture through the fall and are then sold to feedlots or stockers.

Producers should observe the herd carefully during calving season. The cow may need assistance in giving birth or the calf may need attention at birth. The calf needs to nurse shortly after birth (Figure 11-7). The first milk from the cow, called **colostrum**, contains nutrients such as vitamins A and E, and antibodies that the calf requires. It is vitally important for calves,

colostrum

first milk from the mother after birth, rich in antibodies and minerals

FIGURE 11-7

Calves must nurse soon after birth to receive the colostrum or first milk from their mothers.



Courtesy of USDA

as well as other newborn animals, to receive colostrum shortly after birth to ensure good health and a strong immune system.



Science Connection

A healthy calf will stand on its feet and begin nursing shortly after birth. This is a throwback from cattle that were formally wild and subject to predators. It was essential for a newborn calf to be able to move immediately with the herd to escape from any predators. Even though farmed herds are not subject to predators in the same way as wild herds, calves still behave the same.

artificial insemination

the placing of sperm in the female reproductive tract by other than natural means

Artificial Insemination and Embryo Transfer

Artificial insemination and embryo transfer have become popular ways to improve the genetics of the beef herd (Figure 11-8). Using these techniques provides a relatively quick and economical way to improve the characteristics of the herd. With artificial insemination, a bull on the farm is not necessary. The semen from superior animals can be purchased at reasonable prices and shipped across the country quickly. In addition, bull semen can be stored for long periods of time in a liquid nitrogen semen tank. The liquid nitrogen keeps the temperature of the semen at -320°F . Frozen semen can be stored indefinitely if the proper temperature is maintained.



FIGURE 11-8

Artificial insemination is an economical way to improve herd genetics.

embryo transfer

the placement of embryos from one cow into another female that will carry the developing calf until birth

Embryo transfer is the process of removing a fertilized egg from a female and implanting it into another female. The implanted female will carry the developing embryo until birth. Embryo transfer has become common in the cattle industry, but it is expensive and is typically used on the more valuable animals.

Herd Health Plan

A beef producer should develop a plan for maintaining the health of the herd. Prevention is the key to maintaining good herd health. Preventative programs reduce health problems and increase profits. The services of a veterinarian are often needed to plan a herd health program, including vaccination programs and other management tasks (Figure 11-9). A herd health program should be tailored to fit the individual producer based on the breed and age of the cattle, and any prevalent diseases and pests in the region.

Preventative programs are not always enough to keep all disease and health problems under control. Weather, sanitation, overcrowding, and nutrition can also affect the success of a preventative health care plan. Preventative health plans should include



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FIGURE 11-9

A veterinarian should be consulted to develop a herd health program.

FIGURE 11-10

Strict sanitation procedures help to reduce the number of diseases spread from each facility. Here, a person entering the facility walks through a foot bath to reduce tracking in pathogens.



Delmar/Cengage Learning

regular worming and vaccinations to prevent disease and pest problems. Maintaining proper sanitation will also help to alleviate the spread of disease from one animal to another (Figure 11-10). Producers should know their cattle well to be able to identify changes in the animals, especially changes that may indicate illness.

Prevalent cattle diseases depend on the region of the country and other outside considerations. Some of the most prevalent diseases in the cattle business are discussed below. For more information about these and other diseases in your region, please contact a local large animal veterinarian.

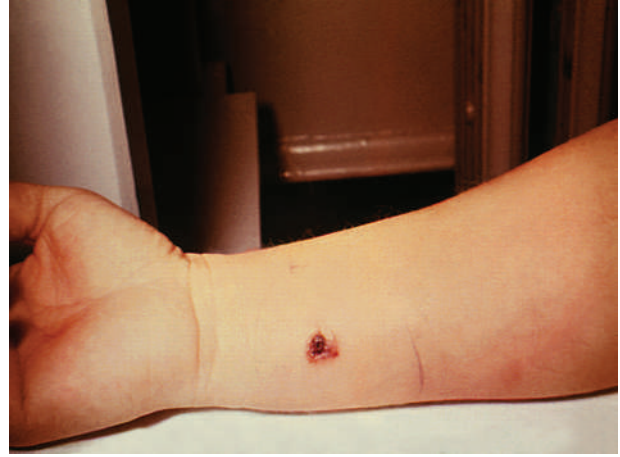
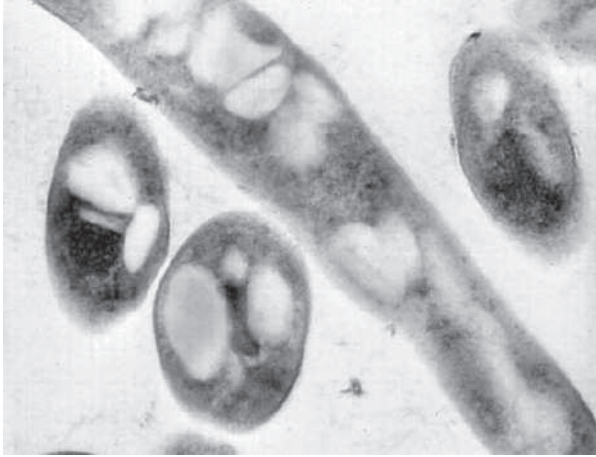
Anthrax

anthrax

an acute infectious disease caused by a spore-forming bacteria

Anthrax is a disease caused by soil bacteria (Figure 11-11). Anthrax affects mainly cattle, goats, deer, and sheep. Infection is caused from grazing on infected pastures. The anthrax bacteria can remain active in the soil for 40 years or longer in a form called a spore. Symptoms include fever up to 107°F, muscle tremors, respiratory distress, and convulsions.

Anthrax bacteria can infect humans. Most humans affected come into contact with the disease through infected animals. Anthrax is most common in developing countries without proper sanitation procedures.



Courtesy of the Centers for Disease Control and Prevention

FIGURE 11-11

Anthrax can be transmitted between animals and humans.

**bovine spongiform
encephalopathy (BSE)**

a disorder affecting the central
nervous system of cattle; also
known as mad cow disease

Bovine Spongiform Encephalopathy (BSE)

Bovine spongiform encephalopathy (BSE) is also known as mad cow disease because the symptoms cause the animal to act abnormally. BSE is a rare disease that affects the central nervous system. Cattle that are affected by BSE show symptoms such as nervousness, muscle twitching, loss of body weight, abnormal posture, uncoordinated movement, difficulty in standing, and will eventually die (Figure 11-12). There is no treatment for this disease. Cattle are thought to have originally been infected with the disease by being fed other infected animal tissues. Because of BSE, it is illegal to feed any animal products to ruminant animals for slaughter.



Economics Connection

THE COW THAT STOLE CHRISTMAS

BSE (mad cow disease) was first diagnosed in Great Britain in 1986. The first case of BSE in the United States was found on December 24, 2003. The date prompted some to dub it the “cow that stole Christmas,” referring to the dramatic economic impact BSE could have on the cattle industry. Several countries, including Japan and South Korea, prohibited U.S. beef imports immediately afterward because of the infected animal.

FIGURE 11-12

Bovine Spongiform Encephalopathy (BSE) is a deadly disease of cattle. Only three cases of BSE have been found in the United States through 2009.



Courtesy of USDA

bovine viral diarrhea virus (BVDV)

a highly contagious, often hard to recognize viral infection in cattle

brucellosis

a bacterial disease causing abortion, sterility, and reduced milk flow

blackleg

bacterial disease in cattle affecting mostly younger animals

Bovine Viral Diarrhea Virus

Bovine viral diarrhea virus (BVDV) is a common disease throughout the United States. BVDV is easily spread from one animal to another. In most cases, symptoms are not recognized as BVDV. This virus attacks the immune system and decreases the animal's ability to fight other infections. Symptoms include fever, coughing, discharge from the nose, rapid breathing, and diarrhea.

Brucellosis

Brucellosis is caused by bacteria and is spread from an infected cow's vaginal secretions or infected afterbirth. This disease causes heavy economic loss in the cattle industry. Cows with brucellosis often abort during the last half of pregnancy. Other symptoms included sterility in cows and bulls, and reduced milk flow in cows. Calves born to infected cows may be weak. There is no cure for brucellosis, but there is a vaccine available for prevention. Good management practices are the best form of prevention.

Blackleg

Blackleg is a disease caused by bacteria. When the bacteria are exposed to air, they form a protective spore (covering), which allows them to live for

many years in the soil. The spores enter the animal through the mouth or through wounds. The disease is most serious when the bacteria lodge in deep wounds.

Young cattle are more commonly affected than older cattle. The first sign of disease may be when one or more animals suddenly die. Before death, the symptoms of blackleg are high fever in the early stages, and then lameness, swollen muscles, and severe depression. The animal may be unable to stand. Most animals are dead before any notice of this disease takes place, since death is rapid. Cattle can be protected from this disease by use of vaccinations.

scours

a disease that causes diarrhea and affects calves under two months of age

Scours

Scours (calf enteritis) is a group of diseases that cause diarrhea. It is a disease of young calves under two months of age. Symptoms of scours vary. The calf may die suddenly or show symptoms, including diarrhea, for several days. Rapid treatment of the infected calves with electrolytes and fluids improves the chances for recovery.

foot-and-mouth disease

a viral disease in cattle that causes painful blisters inside the mouth and on the feet

Foot-and-Mouth Disease

Foot-and-mouth disease is a very serious disease caused by a virus. The disease affects cattle, sheep, pigs, and goats. The virus is easily spread by many means, including animal contact, through the air, and mechanical means such as being passed on shoes or clothing. Infected animals have painful blisters in their mouths and on their feet.

There has not been an outbreak of foot-and-mouth disease in the United States since 1929. However, the disease is so serious that major efforts are made to keep it out of the United States from other countries that are not disease-free. The last outbreak of foot-and-mouth disease in England in 2001 resulted in the loss of 6 million cattle.

shipping fever or **bovine respiratory disease (BRD)**

a respiratory disease caused by bacteria and/or viruses

Shipping Fever

Shipping fever, also known as **bovine respiratory disease (BRD)**, affects the cells lining the respiratory system. Many organisms contribute to BRD, both viruses and bacteria. If the respiratory system is weakened, the animal becomes more susceptible to infections from these pathogens. Bovine respiratory disease is one of the most significant health problems of the beef industry.

BRD is most common in young cattle during times of stress. The stress conditions that contribute to the disease often occur when cattle are transported from one place to another. Heat, cold, dust, exhaust fumes, hunger, fright, and rough handling all create stress.

Nutritional Health Problems

Nutrition plays an important role in the health of animals. Improper nutrition, an imbalance in vitamins and minerals, too much of certain types of feed, and other related nutritional problems can reduce productivity in the herd, and in some cases cause the death of the animals.

Bloat

Bloat of cattle is a problem that occurs when an animal is not able to release gas produced in the rumen (stomach). Rapid fermentation of feed causes too much gas to be produced. The gas creates pressure and swelling in the rumen.

Bloat usually occurs in the spring when cattle graze on lush pastures of legumes such as white clover and alfalfa. The major cause of bloat is eating too much green legume too fast. In the fermentation process, gas is created in great quantities. The animal belches often to relieve this pressure. If the belching mechanism is impaired, or if the gas is being produced too fast, the cow is not able to release

the gas through normal belching. Gas continues to be created in the rumen, and the stomach expands, much like a balloon. The increasing pressure in the rumen can cause death when the rumen presses against the heart and lungs. Treatments include a tube passed through the mouth into the stomach, walking the animal, and administering mineral oil. The last resort to save the animal's life is to actually cut through the hide and into the rumen with a sharp knife to release the gas and relieve the pressure.

Fescue Toxicity

Fescue toxicity is caused by an endophyte, a fungus that lives within the fescue grass plant. The best solution is to kill all the toxic fescue and replant the area with a fescue variety that contains a non-toxic fungus. Endophyte-free fescue is one of the biggest forage research breakthroughs in recent years.

Beef cattle with fescue toxicity are thin, have a fever, and do not shed their winter coats in the spring as other animals usually do (Figure 11-13). The most serious consequence of fescue toxicity is that it can reduce the conception rates of affected cattle from 95 to 70 percent or less.



Courtesy of Dr. Carl Hoveland

FIGURE 11-13

Beef cattle suffering from fescue toxicity.

Grass Tetany

Grass tetany is a serious and often fatal disorder that occurs when a cow has low blood levels of magnesium. It happens most often in older cows during lactation while grazing on pastures that are deficient in magnesium. The problem most often occurs when the cow eats immature foliage, particularly the first flush of new growth in the spring. Early symptoms of grass tetany include excitement, loss of coordination, loss of appetite, trembling of the muscles, convulsions, and coma. Death may occur quickly, sometimes within 30 minutes. Animals seldom recover if not treated within 8 to 12 hours.

External Parasites

External parasites of beef cattle include flies, lice, mange mites, and ticks. Most external parasites feed on the blood of animals, while others just irritate animals. They slow down weight gain and may make an animal not feel well or reduce its appetite. Many external parasites spread disease.



Courtesy of Dr. N. C. Hinkle,
University of Georgia

FIGURE 11-14

Several species of flies are external parasites of cattle. Horseflies (shown here) and other species of flies can cause losses to cattle producers.

systemic insecticide

a chemical that spreads internally throughout the body to reduce or eliminate infection from pests

Flies

Flies that suck the blood of cattle include horn flies, stable flies, horseflies, deerflies, and black flies (Figure 11-14). During times of heavy infestations, animals are not able to graze properly, often resulting in weight loss and decreased milk production. The effect of hundreds of flies, each taking a blood meal one or more times a day, is tremendous. Other flies that irritate and feed on cattle include the housefly, face fly, and heel fly. Flies, as well as mosquitoes, not only annoy animals and cause reduced production, but they also spread diseases.

Control of cattle grubs and flies is accomplished most effectively with systemic insecticides. A **systemic insecticide** is one that spreads internally throughout the body of the animal.

FIGURE 11-15

Mosquitoes transmit diseases to both animals and humans.



Courtesy of Centers for Disease Control and Prevention

Mosquitoes

Approximately 150 species of mosquitoes are known in North America. These bloodsucking insects are pests of livestock, poultry, companion animals, and humans. Both the male and female mosquitoes feed on plant juice and nectar, but only the female feeds on blood (Figure 11-15). Blood is used for egg production. One of the best ways to help control mosquitoes is to remove any standing water in any materials such as old tires, gutters, and ditches. By doing this, suitable places where mosquito eggs may be laid are reduced.

Lice and Mites

Lice and mites irritate cattle and reduce their productivity. These parasites live on or just under the skin of the animal. Both biting lice and bloodsucking lice attack cattle. Mites live on the skin or burrow into the skin. Mites cause several types of mange. One of the most common types of mange, and one that can be transmitted to humans, is scabies (Figure 11-16). Mites are very small in body size and can barely be seen with the eye. They irritate the skin, causing intense itching, pimply areas, and hair loss. Animals rub, scratch, or lick at the affected areas.

FIGURE 11-16

Scabies is a skin disease in cattle caused by mites. Mites can cause economic losses for producers and severe irritation to the animal.



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FIGURE 11-17

Ticks reduce animal production, spread disease, and irritate the animals.



Delmar/Cengage Learning

Ticks

Ticks are bloodsuckers that can transmit serious diseases among cattle (Figure 11-17). Cattle that are infested do not gain weight properly. The tick bites irritate the animal, causing them to rub and scratch at the affected area. This can result in a scabby skin condition or injury.

parasitologist

a scientist who studies parasites

Internal Parasites

There are many species of worms and other organisms that live and feed in the gastrointestinal and respiratory tracts of animals, but only a few are economically important. The occurrence of various types of internal parasites varies by the region of the country. The brown stomach worm can severely damage the stomach, resulting in diarrhea and weight loss, and is considered the single most important parasite of cattle.

Parasites of the stomach and intestine can cause anemia, scouring, depression, and even death. Parasites can also cause poor feed conversion, poor weight gain or weight loss, and decreased milk production. Lungworms can cause pneumonia and inhibit breathing. Some parasites can reduce the animal's ability to reproduce and to produce milk. **Parasitologists** estimate that average numbers of worms can reduce weight gains by 10–20 percent. Economic losses are greatest in young growing calves.

Facilities and Equipment

Careful planning of facilities and selection of equipment for beef cattle enterprises is important for the success of the operation. There are many different kinds of beef cattle operations. The kind of facilities and equipment vary with each individual farm.

Careful planning before building can make cattle handling easier. Facilities must be planned to be as safe as possible for the operator and the cattle. Wise planning also helps to save labor.

Several pens are necessary in the corral for holding and working cattle (Figure 11-18). Water must be available in holding pens. Feed bunks may be needed if the cattle are to be held for more than a few hours. Access must be provided to the sorting and crowding pens, and to the working chute. A corral should have at least two sorting pens.

FIGURE 11-18

Holding areas for cattle should be functional and safe.



Delmar/Cengage Learning

squeeze chute and **head gate**
structures used to hold cattle while
treatments are performed

A minimum requirement is that the working chute be large enough to hold at least three animals at one time. The chute must be narrow enough so that the cattle cannot turn around. Many operations, such as parasite control, tattooing, branding, and veterinary treatments, are performed in the working chute.

The **squeeze chute** and **head gate** are the center of the cattle working facilities. Most commercially available squeeze chutes come equipped with a head gate. Together, they are used to hold the cattle for various treatments. After the work on the animal is completed, the device is opened and the animal is released (Figure 11-19).

A loading chute should be included in the corral design. The sides of the loading chute should be solid so that the cattle cannot see out. The top of the chute should be adjustable for different sizes of trucks.

Feedlots

Feedlots concentrate many animals in a relatively small area (Figure 11-20). Facilities must be well-planned to avoid problems. Dirt mounds are used to keep cattle out of the mud. Concrete strips are sometimes installed along feed bunks and waterers. A site with good internal and external drainage is important.

FIGURE 11-19

Chutes and alleyways should be in good working condition. This figure shows the entry into a squeeze chute and a cow in the chute for treatment.



Delmar/Cengage Learning

FIGURE 11-20

Cattle in feedlots are concentrated into small areas.



Courtesy of Hirsch Enterprises; Guymon, Oklahoma



Courtesy of Cathy Collett, Livestock Marketing Association

FIGURE 11-21

Cattle being sold at a livestock auction barn.

Marketing

Producers utilize a number of options in the marketing of beef cattle. Some producers sell their cattle at public stockyards (Figure 11-21). Cattle are usually separated into groups by size and weight where they are sold as lots. This system mixes cattle from several different producers. Producers usually pay a percentage of the value of the animal in exchange for the services provided by the stockyard.

Many other marketing methods are also used. Producers may sell directly to the feedlot or a stocker operator. Video and internet auctions have become popular, especially for larger producers or for purebred producers. Producers will need to take into consideration the costs and time required for each marketing option. The size of their operation is a major factor in market options.

Summary

Beef cattle production requires good management to be productive and profitable. Beef cattle are produced in every state in the United States in small to very large herds. The three divisions of the beef industry are

cow-calf, stocker, and feedlot operations. Breeding management is the most important aspect in cow-calf operations. The objective is to have a calf from every cow every year—a 100 percent calf crop, although this objective is rarely achieved. Artificial insemination and embryo transfer have become widely popular, making it possible to rapidly spread the genetics of superior animals.

Feeding cattle economically is a key factor in making a profit. In cow-calf and stocker operations, cattle can get almost all of their feed from good pastures. Feeder cattle in feedlots are given high-energy feed that is more expensive, such as corn. The amount of feed that cattle will consume is related to many factors, such as the energy level of the ration, feed palatability, and the desired degree of finish on the cattle. In cow-calf operations, cattle are fed based on their body condition score (BCS). Intensive or rotational grazing produces more total forage than traditional grazing.

A beef producer should develop a plan for maintaining a healthy herd. Prevention is the key to maintaining good herd health. A beef producer should be aware of and be able to identify signs of healthy cattle, as well as signs of sick and weak cattle.

Internal and external parasites suck blood and should be controlled because they annoy cattle and reduce productivity. Of the internal parasites, on a national level, the brown stomach worm causes the greatest productivity loss in beef cattle. Flies, mosquitoes, and other external parasites cause great irritation to the animal, and also cause weight loss due to their feeding on the animal's body or blood.

Careful planning of facilities and equipment for beef cattle enterprises are important for the success of the operation. The kind of facilities and equipment vary with the type of cattle operation. Holding pens are needed for any kind of beef cattle operation. The squeeze chute and head gate are essential features of a corral and are the center of operations in treating beef cattle.

Quick Facts

- | | |
|---|---|
| ■ The most cost-effective way to feed cattle is on pasture. | weight gains and increased carcass quality. |
| ■ Finishing is the increased feeding of high-energy feeds just before harvest, resulting in rapid | ■ Beef cattle generally decrease feed intake in hot weather and increase feed intake in cold weather. |

- An ideal body condition score (BCS) for bulls and cows is 5.
- The conception rate is higher for cows that are gaining weight just before and during breeding season.
- The birth of all calves in the herd should occur during a 40–60 day period.
- The first milk from the cow, called colostrum, contains nutrients, such as vitamins A and E, and antibodies that the calf requires.
- Artificial insemination is the placing of sperm in the female reproductive tract by other than natural means.
- Embryo transfer is the placement of a fertilized egg in a recipient cow that will carry the calf to birth.
- Anthrax is a disease caused by bacteria that can remain in the soil for 40 years or longer.
- The first case of mad cow disease (Bovine Spongiform Encephalopathy) in the United States was found on December 24, 2003.
- Brucellosis is caused by a microorganism, and it is known to cause heavy economic loss in the cattle industry.
- Enteritis (scours) is a disease of young calves.
- Although the United States has not had a case of foot-and-mouth disease since 1929, it remains one of the most serious threats to the cattle industry.
- External and internal parasites of beef cattle annoy cattle, as well as reduce production.
- The major cause of bloat is eating too much green legume too fast.
- A corral with a squeeze chute and head gate is the center of operations for treating beef cattle.
- Bovine Respiratory Disease (BRD) is one of the most significant health problems of the beef industry.

Student Learning Activities

1. Visit local cattle producers to observe their production systems. Ask why they follow certain systems.
2. Observe various methods of preparing feed for cattle on local farms.
3. Observe a veterinarian or beef cattle producer administering vaccinations and executing other common herd health practices.
4. Ask a veterinarian to talk to the class about cattle health problems.
5. If planning and conducting a beef cattle supervised agricultural experience program, plan and build appropriate facilities for the project.

Discussion Questions

1. Explain the use of roughages in cattle production systems.
2. Discuss the facilities that are used to handle cattle.
3. What are some of the diseases that affect beef cattle?
4. What is colostrum and why is it important?
5. What is BSE and why is it important to the food supply?

Review Questions

True/False

1. It is better to prevent health problems than to try to cure them once they occur.
2. In planning a beef housing facility, future expansion is not important.
3. Foot-and-mouth disease has not been found in the United States since 1950 and is of little economic concern.
4. Scours affects all cattle, both young and old.
5. It is not important to notice if the animals are showing any symptoms of disease.

Multiple Choice

1. Anthrax is a disease caused by bacteria that may remain in the soil for _____ years or longer.
 - a. 20
 - b. 30
 - c. 40
 - d. 50
2. Grasses used for pasture or hay include which of the following?
 - a. fescue grass
 - b. Bermuda grass
 - c. orchard grass
 - d. all of the above
3. What does BSE stand for?
 - a. Bovine Spongiform Encephalopathy
 - b. Bovine Spinal Encephalopathy

- c. Bovine Separation Entropy
 - d. Bovine Skin Eczema
4. There is/are _____ disease organism(s) that contribute(s) to calf scours.
- a. one
 - b. two
 - c. three
 - d. numerous
5. _____ is the placement of viable embryos into a cow's uterus.
- a. Artificial insemination
 - b. Embryo transfer
 - c. Flushing
 - d. Receiving

Completion

1. Embryo transfer and _____ have become popular in recent years as affordable methods of producing genetically superior offspring in beef cattle and other animals.
2. A number of feed _____ and _____, called growth-promoting pharmaceuticals, are available for finishing cattle.
3. Some _____ used for feeding beef cattle include clover, lespedeza, peanut hay, alfalfa, and soybean hay.
4. The _____ and _____ are essential features of a corral and are the center of operations when treating cattle.
5. Cows with _____ often abort during the last half of pregnancy.

Short Answer

1. List a few advantages that corral systems provide.
2. How do parasites reduce production and profits?
3. Explain the finishing process of beef cattle.
4. Name three of the most economically important cattle diseases and a prevention plan for them.
5. What is the main feedstuff for a cow-calf operation? Why?



CHAPTER 12

Selecting and Judging Beef Cattle

OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe the factors used to evaluate beef cattle.
- Identify the parts of a beef animal.
- Describe the criteria used to select superior animals.
- Evaluate the conformation of beef cattle in market and breeding classes.
- Differentiate between market and breeding classes.
- Utilize proper beef cattle terminology giving oral reasons in cattle judging.
- Evaluate animals within a judging class and propose a final placing.

KEY TERMS

conformation	dam	finish
ultrasonics	heritability	carcass merit
frame score	pedigree	yield grade
sire	sire summary	quality grade
performance record	Expected Progeny Difference (EPD)	yield
production testing	Maternal Breeding Value (MBV)	quality
brood animal	type	balance
progeny testing	muscling	style
performance testing		smoothness

LANGUAGE CONNECTION

English	French	Spanish	German	Italian
Frame	Cadre	El Cuerpo	Rahmen	Telaio
Finish	Finition	Acabado	Finish	Finitura
Style	Style	El Estillo	Stil	Stile
Deep	Profond	Profundo	Tief	Profondo
Stout	Stout	Robusto	Stout	Corpulento
Thick	Épais	Grueso	Dick	Spesso

Selection of Beef Animals

A beef herd is improved by selecting and breeding animals that have the most desirable traits. Selective breeding helps the producer to provide the type of products that are in demand by consumers. Selection is based primarily on conformation and performance records. Producers must consider a number of performance traits when selecting beef animals.

Conformation

Conformation refers to the appearance of the live animal. It includes the skeletal structure, muscling, fat balance, straightness of the animal's lines, and structural soundness. To describe the conformation of the animal, one must first learn the parts of the animal. The parts of the beef animal are identified in Figure 12-1.

Desirable conformation of the beef animal includes:

- ▶ Long, trim, deep-sided body.
- ▶ No excess fat on the brisket, fore flank, or hind flank.
- ▶ No extra hide around the throat, dewlap, or sheath.
- ▶ Heavily muscled forearm.
- ▶ Proper height to the point of the shoulders.

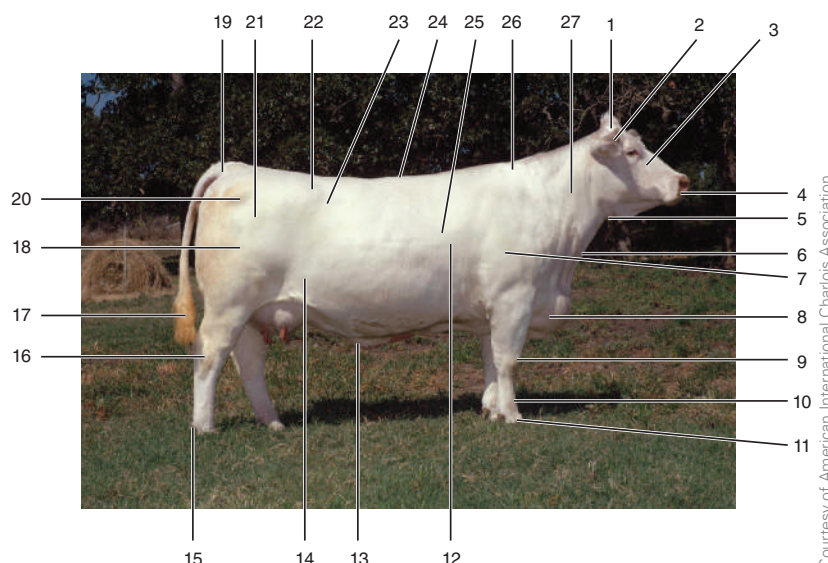
conformation

the appearance of the live animal; the type, form, and shape of the animal

- | | |
|----------------------|----------------------|
| 1. Poll | 15. Dew Claw |
| 2. Ear | 16. Hock |
| 3. Face | 17. Switch |
| 4. Muzzle | 18. Quarter or round |
| 5. Throat | 19. Tail Head |
| 6. Dewlap | 20. Pins |
| 7. Point of Shoulder | 21. Rump |
| 8. Brisket | 22. Hooks |
| 9. Knee | 23. Loin |
| 10. Pastern | 24. Back |
| 11. Hoof | 25. Ribs |
| 12. Heart Girth | 26. Crops |
| 13. Belly | 27. Neck |
| 14. Flank | |

FIGURE 12-1

Parts of the beef animal.



Courtesy of American International Charolais Association

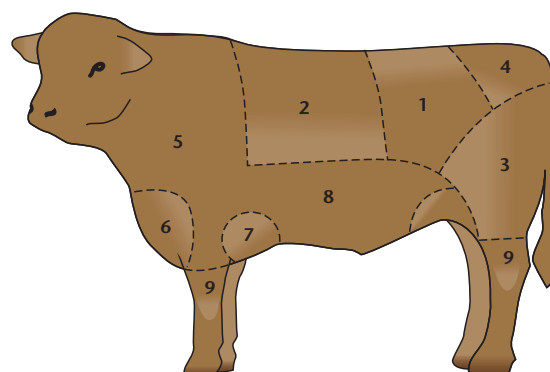
- ▶ Correct muscling throughout the body.
- ▶ Maximum development of the round, rump, loin, and rib.

An animal with the proper conformation will produce the maximum amount of high-value meat cuts in proportion to the bone and internal organs. It is necessary to learn the wholesale cuts of the beef animal to properly evaluate the live animal. Figure 12-2 shows the location of the high-value and low-value wholesale cuts of beef. The high-value wholesale cuts come from the round, rump, loin, and rib. The low-value wholesale cuts come from the chuck, brisket, flank, plate or navel, and shank.

Ultrasonics is the use of high-frequency sound waves to measure fat thickness and loin-eye area.

ultrasonics

the science and application of high frequency sound waves that may be used to measure fat thickness and loin eye area in beef cattle



High-value Wholesale Cuts:

1. Loin
2. Rib
3. Round
4. Rump

Low-value Wholesale Cuts:

5. Chuck
6. Brisket
7. Flank
8. Plate or navel
9. Shank

FIGURE 12-2

Location of high- and low-value wholesale cuts of beef.

Delmar/Cengage Learning

Beef Made Easy®

Retail Beef Cuts and Recommended Cooking Methods

Category	Cut	Recommended Cooking Methods
Chuck	CHUCK 7-BONE POT ROAST *	Skillet, Pot Roast
	CHUCK POT ROAST Boneless	Skillet, Pot Roast
	CHUCK STEAK Boneless	Skillet, Pot Roast
	CHUCK EYE STEAK Boneless	Skillet, Pot Roast
	SHOULDER TOP BLADE STEAK	Skillet, Pot Roast
	SHOULDER TOP BLADE STEAK Flat Iron	Skillet, Pot Roast
	SHOULDER POT ROAST *	Skillet, Pot Roast
	SHOULDER STEAK *	Skillet, Pot Roast
	SHOULDER CENTER * Ranch Steak	Skillet, Pot Roast
	SHOULDER PETITE TENDER *	Skillet, Pot Roast
	SHOULDER PETITE TENDER MEDALLIONS *	Skillet, Pot Roast
	BONELESS SHORT RIBS	Skillet, Pot Roast
Rib	RIB ROAST	Skillet, Pot Roast
	RIB STEAK	Skillet, Pot Roast
	RIBEYE ROAST Boneless	Skillet, Pot Roast
	RIBEYE STEAK Boneless	Skillet, Pot Roast
	BACK RIBS	Skillet, Pot Roast
Loin	PORTERHOUSE STEAK	Skillet, Pot Roast
	T-BONE STEAK *	Skillet, Pot Roast
	TOP LOIN STEAK * Bone-in	Skillet, Pot Roast
	TOP LOIN STEAK * Boneless	Skillet, Pot Roast
	TENDERLOIN ROAST *	Skillet, Pot Roast
	TENDERLOIN STEAK *	Skillet, Pot Roast
Sirloin	TRI-TIP ROAST *	Skillet, Pot Roast
	TRI-TIP STEAK *	Skillet, Pot Roast
	TOP SIRLOIN STEAK * Boneless	Skillet, Pot Roast
Round	TOP ROUND STEAK *	Skillet, Pot Roast
	BOTTOM ROUND ROAST *	Skillet, Pot Roast
	BOTTOM ROUND STEAK * Western Griller	Skillet, Pot Roast
	EYE ROUND ROAST *	Skillet, Pot Roast
	EYE ROUND STEAK *	Skillet, Pot Roast
	ROUND TIP ROAST *	Skillet, Pot Roast
	ROUND TIP STEAK *	Skillet, Pot Roast
	SIRLOIN TIP CENTER ROAST *	Skillet, Pot Roast
	SIRLOIN TIP CENTER STEAK *	Skillet, Pot Roast
	SIRLOIN TIP SIDE STEAK *	Skillet, Pot Roast
Shank and Brisket	SHANK CROSS CUT *	Skillet, Pot Roast
	BRISKET FLAT CUT *	Skillet, Pot Roast
Plate and Flank	SKIRT STEAK	Skillet, Pot Roast
	FLANK STEAK *	Skillet, Pot Roast
	GROUND BEEF	Skillet, Pot Roast
	CUBED STEAK	Skillet, Pot Roast
	BEEF FOR STEW	Skillet, Pot Roast
Other	BEEF FOR KABOBS	Skillet, Pot Roast
	BEEF FOR STIR-FRY OR FAJITAS	Skillet, Pot Roast

Key to Recommended Cooking Methods

- Skillet
- Grill or Broil
- Marinate & Grill or Broil
- Stir-Fry
- Roast
- Stew
- Braise
- Pot Roast

* These cuts meet government guidelines for "lean" and are based on cooked servings with visible fat trimmed.

Lean is defined as less than 10 grams of total fat, 4.5 grams of saturated fat, and less than 95 milligrams of cholesterol per serving and per 100 grams (3.5 oz).

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FIGURE 12-3

Retail cuts of beef.

frame score

a measurement of a calf at 205 days of age to estimate mature size of the animal

sire

the male parent of an animal

performance record

the data collected on each animal or herd of animals based upon performance

production testing

measurement of a brood cow's production based upon performance of her offspring

brood animal

an animal that is kept for the purpose of breeding

progeny testing

determining the breeding value of a bull based upon the performance of its offspring

performance testing

collecting data on beef cattle herds used to select the most productive animals

Ultrasonics is a useful tool for selecting desirable animals for breeding purposes. The measurement is made on live animals.

The **frame score** is a measurement based on observation and height measurements when calves are 205 days of age. An estimate of the expected size of the animal when it reaches maturity can be made from its frame score. The use of the frame score in a herd **sire** selection provides a more accurate prediction of the expected genetic change in the herd.

Frame scores are made on a 1 through 7 scale. The higher the frame score, the larger the frame of the animal. The scores represent a range in body types of beef cattle. The English breeds of beef cattle are usually covered by body types 1 through 5. Charolais, Simmental, and similar-size cattle of other breeds usually require the use of body types 3 through 7. The age of the animal is a factor in determining its frame score and hip height (Figure 12-4). The frame score is a valuable tool for selecting replacement heifers and herd bulls. It is used by state and USDA cattle graders in beef performance testing programs.

Performance Records

One of the best ways to select beef animals is on the basis of **performance records**. Performance records can be based on individual animals or for the herd. They consist of data that is collected on the animals related to growth, fertility, and carcass traits. **Production testing** refers to measuring a brood cow's production by the performance of her offspring. A **brood animal** is an animal held for breeding. **Progeny testing** usually refers to the evaluation of a bull by the performance of its offspring. **Performance testing** may be defined as a method of collecting records on beef cattle herds to be used for selecting the most productive animals. Visual evaluation alone is not enough to select the best animals.

Frame Score for Bulls Based on Hip Height in Inches, Ages 5 to 21 Months						
Age in Months	Frame Score 2	Frame Score 3	Frame Score 4	Frame Score 5	Frame Score 6	Frame Score 7
5	35.5	37.5	39.5	41.6	43.6	45.6
6	36.8	38.8	40.8	42.9	44.9	46.9
7	38.0	40.0	42.1	44.1	46.1	48.1
8	39.2	41.2	43.2	45.2	47.2	49.3
9	40.2	42.3	44.3	46.3	48.3	50.3
10	41.2	43.3	45.3	47.3	49.3	51.3
11	42.2	44.2	46.2	48.2	50.2	52.2
12	43.0	45.0	47.0	49.0	51.0	53.0
13	43.8	45.8	47.8	49.8	51.8	53.8
14	44.5	46.5	48.5	50.4	52.4	54.4
15	45.1	47.1	49.1	51.1	53.0	55.0
16	45.6	47.6	49.6	51.6	53.6	55.6
17	46.1	48.1	50.1	52.0	54.0	56.0
18	46.5	48.5	50.5	52.4	54.4	56.4
19	46.8	48.8	50.8	52.7	54.7	56.7
20	47.1	49.1	51.0	53.0	55.0	56.9
21	47.3	49.2	51.2	53.2	55.1	57.1

Frame Score for Heifers Based on Hip Height in Inches, Ages 5 to 21 Months						
Age in Months	Frame Score 2	Frame Score 3	Frame Score 4	Frame Score 5	Frame Score 6	Frame Score 7
5	35.1	37.2	39.3	41.3	43.4	45.5
6	36.2	38.2	40.3	42.3	44.4	46.5
7	37.1	39.2	41.2	43.3	45.3	47.4
8	38.0	40.1	42.1	44.1	46.2	48.2
9	38.9	40.9	42.9	44.9	47.0	49.0
10	39.6	41.6	43.7	45.7	47.7	49.7
11	40.3	42.3	44.3	46.4	48.4	50.4
12	41.0	43.0	45.0	47.0	49.0	51.0
13	41.6	43.6	45.5	47.5	49.5	51.5
14	42.1	44.1	46.1	48.0	50.0	52.0
15	42.6	44.5	46.5	48.5	50.5	52.4
16	43.0	44.9	46.9	48.9	50.8	52.8
17	43.3	45.3	47.2	49.2	51.1	53.1
18	43.6	45.6	47.5	49.5	51.4	53.4
19	43.9	45.8	47.7	49.7	51.6	53.6
20	44.1	46.0	47.9	49.8	51.8	53.7
21	44.2	46.1	48.0	50.0	51.9	53.8

Courtesy of Beef Improvement Federation

FIGURE 12-4

Frame score can be determined by measuring an animal's height at the hip and matching it to the age of the animal in months.

The height under each frame score is the minimum height for that score.

Birth and weaning weights are important measurements in performance data collection (Table 12-1). Weaning weight is adjusted to a 205-day weight so that all calves in the herd can be compared on an equal basis. Weaning weight at 205 days is a standard performance measurement in the beef cattle industry, and is recommended by the National Beef Improvement Federation. The weaning weight

TABLE 12-1

Breed Standard Birth Weights Used
in Performance Testing Programs

Breed	Sex of Calf			
	Females		Males	
	(lb)	(kg)	(lb)	(kg)
Angus	65	29.2	75	34.0
Charolais	85	38.6	85	38.6
Chianina	80	36.3	80	36.3
Hereford	70	31.8	75	34.0
Polled Hereford	70	31.8	75	34.0
Limousin	75	34.0	80	36.3
Maine-Anjou	84	38.1	90	40.8
Shorthorn	70	31.8	70	31.8
Simmental	83	37.6	91	41.3

dam

the female parent of an animal

heritability

the ability of genetic traits to
be transmitted from parent to
offspring

pedigree

the record of a particular animal's
ancestry

is adjusted for the age of the calf, the age of the **dam**, and the sex of the calf.

The performance of an animal depends on genetics and the environment. The amount of improvement that can be expected from selecting superior animals depends on the heritability of the traits. The **heritability** of a trait is the degree to which the performance of the animal can be attributed to genetics. Heritability above 40 percent is high and below 20 percent is low (Table 12-2).

Pedigree

A **pedigree** is the record of the ancestors of an animal. It usually contains only the names of the ancestors, but may contain performance data. A person must be familiar with the performance of the individuals in the pedigree if it is to have much value in selection. In animal breeding, the best animals are often well known in the industry. Animals may be more valuable if they belong to a given bloodline.

Other Factors in Selection

Only healthy animals should be brought into the herd. Purchases should be made only from reputable producers. The buyer should check the health

TABLE 12-2

Heritability Estimates for Beef Cattle

Trait	Heritability (%)
Number born	5
Calving interval (fertility)	10
Percent calf crop	10
Services per conception	10
Conformation score at weaning	25
Cancer eye susceptibility	30
Gain on pasture	30
Weaning weight	30
Yield grade	30
Carcass grade	35
Age at puberty	40
Birth weight	40
Body condition score	40
Carcass—percent lean cuts	40
Conformation score at slaughter	40
Cow maternal ability	40
Efficiency of gain	40
Preweaning gain	40
Yearling frame size	40
Yearling weight	40
Fat thickness	45
Feedlot gain	45
Dressing percent	46
Marbling score	50
Mature weight	50
Scrotal circumference	50
Tenderness	50
Final feedlot weight	60
Retail yield	60
Rib eye area	70

of an animal carefully before buying it. Any animal that displays any sickness should not be brought into an existing healthy herd. Sick animals in the herd should be quarantined from otherwise healthy animals.

FIGURE 12-5

Sire selection is one of the most important producer decisions. Pictured here is a Romangnola bull. Each calf receives one half of its genetics from the bull.



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Selection of the Herd Bull

The selection of the herd bull is one of the most important decisions the cattle breeder may make (Figure 12-5). Each calf produced receives one-half of its genetic makeup from the sire. When replacement females are selected from the herd, 87.5 percent of the heifer's genetic makeup comes from the last three bulls in her pedigree. While a bull contributes 50 percent of the genetics to his offspring, he is also responsible for 25 percent of the genetics in his granddaughters and 12.5 percent of the genetics in his great granddaughters.

Sire summaries provide information on traits that are economically important to cattle producers. Included is information regarding the ability of the bull to transmit desirable traits to his offspring. This includes information about expected birth, weaning, and yearling weights.

The ability of the bull to transmit genetic traits to his offspring is called **Expected Progeny Difference (EPD)**. The EPD is a measure of the degree of difference between the progeny of the bull and the progeny of the average bull of the breed for the trait being measured. An EPD is calculated from data collected on the calves of the bull. The EDP values for bulls of a given breed can be compared. A program

sire summary

a comparison chart that allows for the evaluation of a bull for desirable traits that may be passed to his offspring

Expected Progeny Difference (EPD)

a measurement of the degree of difference of the progeny of a bull to the progeny of the average bull of the breed

FIGURE 12-6

This sire summary allows the comparison of Bull A to Bull B. From this data we can predict that calves from Bull A will average 6 pounds heavier at birth and weigh 15 pounds more at weaning than calves from Bull B.

Maternal Breeding Value (MBV)

an estimate of how the daughters of a bull are expected to perform

Sire Summary Birth Weights and Growth EPDs for Two Bulls		
Bull	Birth Weight	Weaning Weight
A	+4	+20
B	-2	+5
Difference	6	15

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that compares EPD values between breeds allows producers to select sires for crossbreeding programs that will improve the herd.

The **Maternal Breeding Value (MBV)** regarding the daughters of a bull is also included in the sire summary. MBVs give an estimate of how the daughters of a bull are expected to perform.

The data from a sire summary can be used to select herd sires that are superior for desired traits. Figure 12-6 provides an example. Calves sired by Bull A are predicted to weigh 6 pounds more at birth and 15 pounds more at weaning than calves sired by Bull B.

The cow herd needs to be evaluated before selecting the herd bull. Improvements needed must be identified. Then the data from a sire summary can be used to select a bull that will be more closely matched to the herd needs.

The bull should have no apparent physical or genetic defects. Bulls that have poor conformation should not be selected. The bull should also have a quiet disposition. Bulls that have unruly dispositions tend to produce calves of the same disposition, and may not perform well in the feedlot.

Judging Beef Animals

Young people interested in livestock production and related careers often get their first experience in beef selection through the FFA, 4-H, or collegiate livestock judging events. Judging beef animals consists

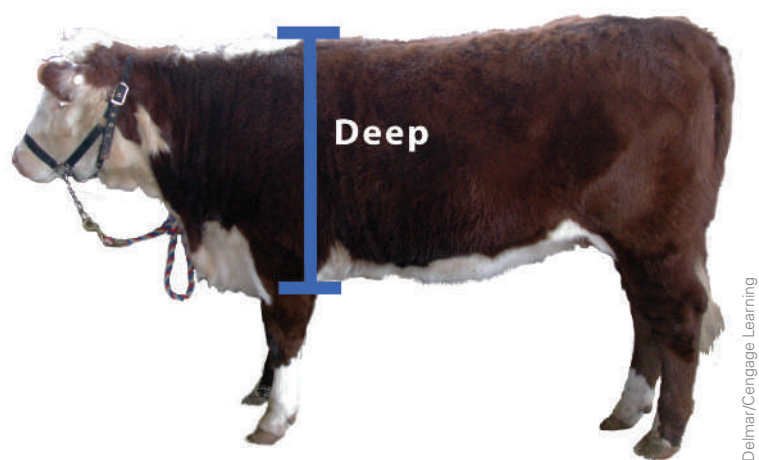
of comparing one animal to another based on the conformation and sometimes performance data. The animals are divided so that there are four animals in a judging class. The four animals in each class are ranked from most desirable to least desirable.

Student judges with little or no experience should use the following guides when first starting to judge animals in a competition.

- ◀ *Deep* – how deep the animal is from the top of the shoulder behind the front leg to the bottom of the chest (Figure 12-7)
- ◀ *Stout* – from the front of the animal, how wide the bottom of the chest is between the front legs, and from the rear of the animal, the width of the hips (Figure 12-8A and B)
- ◀ *Thick* – from the front and back of the animal, how thick the animal is overall, from shoulders to tail (Figure 12-9)

The following is a summary of accepted judging procedures. First, look at the animals from a distance of about 20 feet in order to see all the animals at once. Look over the class, comparing animals from the side, front, and rear. Keep in mind that the major differences among the animals will help to decide the preliminary placings. The first impression of the class is usually best (Figures 12-10 through Figure 12-12). Continue to observe each animal to confirm or change the preliminary placing. To evaluate the animals within the class, the judge divides the four animals (e.g., 1-2-3-4) into three pairs: a top pair (1-2), a middle pair (2-3), and a bottom pair (3-4).

As the animals are walked, look for faults. The animal should move freely with a natural stride. Study each animal individually and then make comparisons. The final placing is indicated by listing the numbers of the animals in the order of their placing. For example, if the number 3 animal was placed first, the number 1 animal placed second, the number 4 animal placed third, and the number 2 animal placed fourth, the final placing would be stated 3-1-4-2.



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FIGURE 12-7

Beef animals should be deep through the body.



Delmar/Cengage Learning; Courtesy of Randy Glance

FIGURE 12-8A

Beef animals should be stout (wide) in the front, indicating good muscling and capacity.



Courtesy of Ray Herren

FIGURE 12-9

A beef calf should show overall thickness from front to back.



Delmar/Cengage Learning; Courtesy of Randy Glance

FIGURE 12-8B

A beef animal should be stout (wide) when viewed from the rear.



Courtesy of Ray Herren

FIGURE 12-10

Looking at animals from the side helps to determine the overall balance of the animal.



Courtesy of Ray Herren

FIGURE 12-11

Beef animals should be balanced with good muscling throughout.



Courtesy of Ray Herren

FIGURE 12-12

This beef animal has indication of good muscling in the rear quarters.

FIGURE 12-13

A steer with good balance between the front and rear.



Courtesy of Ray Herren

type

the overall conformation of the animal

muscling

the meatiness of the animal

finish

the fat cover between the skin and muscle

carcass merit

the qualities of the carcass when the animal is harvested, which is expressed by yield grade and quality grade

Judging Market Classes

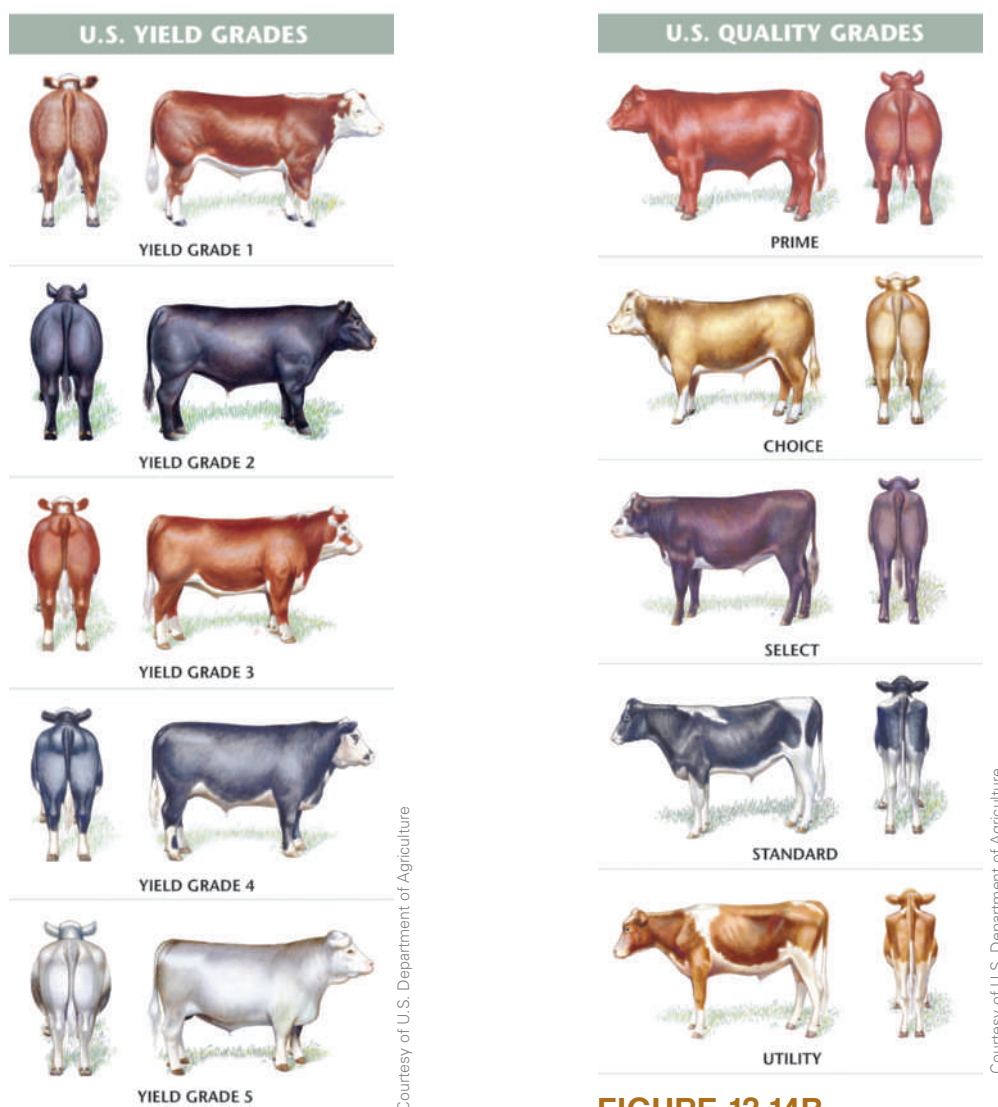
The main points to look for in judging the market classes are: (1) type, (2) muscling, (3) finish, (4) carcass merit, (5) yield, (6) quality, (7) balance, (8) style, and (9) smoothness. These points are described below. Please refer to Figures 12-12 and 12-13 for reference.

Type refers to the general conformation of the animal, and is best determined from the side view. The type most in demand is a thick, moderately deep-bodied animal. It should have medium length of leg and body, with straight lines and good balance.

Muscling refers to the meatiness of the animal. The animal's quarters should be thick, deep, and full. The back, loin, and rump should be wide without too much fat (Figure 12-13).

The fat cover between the skin and muscle is called **finish**. The term finish is used only in market classes. A smooth, uniform finish is desirable. The animal must not be too fat or too thin.

Carcass merit refers to the kind of carcass the animal will produce when harvested. Carcass merit must be estimated when judging live animals. A desirable carcass is thick, meaty, and correctly finished. There should be a lot of muscle in the high-priced cuts. The carcass merit of cattle is expressed by yield grade and quality grade (Figure 12-14A and B). There are five yield grades, numbered 1 through 5. The fatter

**FIGURE 12-14A**

Slaughter steers – U.S. yield grades.

FIGURE 12-14B

Slaughter steers – U.S. quality grades.

yield grade

the percent of carcass weight in boneless retail cuts after the fat has been trimmed off; expressed as a numerical score of 1 to 5

quality grade

the grade given to beef that indicates the eating quality of the meat

the animal, the smaller the percent of yield, since more fat must be trimmed from the retail cuts. **Yield grade** shows the percent of carcass weight in boneless retail cuts (round, loin, rib, and chuck) that have been closely trimmed of fat. While most cattle have a yield grade of 2 or 3, fatter cattle will have a yield grade of 4 or 5. Heavily muscled cattle will have a yield grade of 1.

Quality grade refers to the amount of marbling and the carcass grade (Prime, Choice, Select, Standard, Commercial, Utility, Cutter, and Canner) of the animal. Quality grade refers to the eating quality of the meat. It is evaluated primarily by finish, age marbling, maturity, color, firmness, and texture of the meat.

yield

the weight of the chilled carcass compared to the live weight; this is known as the dressing percent

quality

refinement of the head, hide, bone, and hair

balance

structure and proportion of the animal's body

style

the manner in which the animal carries itself

smoothness

a lack of roughness in the finish and bone structure

Yield is the dressing percent (weight of the chilled carcass compared to the live weight) of the animal. It is found by dividing the chilled carcass weight by the live weight of the animal. This gives a percent, which indicates yield. A high yield is desirable.

Quality refers to the refinement of the head, hide, bone, and hair. An animal should be medium boned. The head should be moderately refined, and the hide should be thin and pliable. A soft, fine hair coat is desirable.

Balance refers to the general structure and proportion of the animal's body. A desirable animal is correctly proportioned.

Style means the way the animal shows and the way it carries itself. It should be attractive and alert, and show to good advantage.

Smoothness refers to the lack of roughness in the finish or bone structure. Rough finish can usually be seen along the top of the animal. Rough bone structure can be seen at the shoulders and hooks. A desirable animal will be smooth rather than rough.

Judging Breeding Classes

Breeding classes are judged for several additional traits, as well as those listed for market classes. These are (1) condition, (2) size, (3) feet, legs, and bone, (4) breed character, and (5) sex character.

- ◀ *Condition* refers to the amount of fat a breeding animal is carrying. This is referred to as finish for market classes. Muscling is more important than condition when judging breeding cattle. This is because muscling is an inherited trait which is desirable to be passed on to the offspring.
- ◀ *Size* is an important judging consideration. A large animal is better than a small one when both are the same age. Size alone is not the only trait to look for, but is very important.
- ◀ *Legs* should be strong and straight with heavy bones. The legs should be set well on the animal and have no obvious defects.

- ◀ *Feet* must be large enough to give a good foundation for the animal. Unsoundness in feet and legs makes the animal less valuable for breeding stock.
- ◀ *Bone structure* in breeding animals should be adequate to support muscling and growth.
- ◀ *Breed character* is shown in the head and general appearance of the animal. Each breed has its own traits. A good judge must study the traits of the breeds in order to recognize appropriate breed character.
- ◀ *Sex character* refers to male and female traits. The male should have more muscle development than females. The overall appearance of a male should be massive and powerful. A female should look more feminine with more refinement in the head, neck, shoulder, and bones.

Oral Reasons

Students who judge livestock may be required to give oral reasons to the official livestock judge. Oral reasons are given to explain the differences between the animals and to justify placings. A good judging habit is to take notes to keep the placing decisions in order. For instance, a class placing of 2-3-1-4, has animals 2 and 3 in the top pair, 3 and 1 in the middle, and 1 and 4 in the bottom. When giving oral reasons, the student should give reasons between only the two animals in the pair. (i.e., animal 1 places over animal 4 for the following reasons.)

The most common format for reasons is called the grant/criticize format. Within each pair, an animal is described and the animal that follows in placing order is granted certain strengths and is then criticized. The set of reasons should be formal and professional. The differences between two animals are described, for example,

“In the top pair of today’s class of beef heifers, heifer 2 is placing over heifer 3 for the following reasons. Heifer number 2 is a deeper and stouter female with a thick

flank. She also shows more feminine characteristics than the heifer standing behind her in second place. I grant that heifer 3 is a longer neck heifer and is more level from hooks to pins."

This example applies to the top pair. The contestant would then explain their reasons for placing of the middle and bottom pair.

Taking Notes Notes should be taken while judging the class if oral reasons are to be given (Figure 12-15). They are used to prepare the oral reasons. Notes are not read to the judge. One way to take notes is to divide the paper into three columns. The first column is headed *Reasons for Placing*. The second is for *Admits or Grants*. The third column lists *Faults*. Use fractions for the top, middle, and bottom pairs. For example, 3/2 indicates the number 3 animal is placing over the number 2 animal. Note what is seen for each pair in the three columns.

Crossbred Steers - Market - Placing 3-2-1-4		
<u>Reasons for placing</u>	<u>Admits or Grants</u>	<u>Faults</u>
3/2 longer rump and loin, heavier muscled, stronger top	2/3 trimmer middled	2 weaker top, rough shoulders
2/1 longer loin and rump, wider through quarter more muscular round, uniformly fleshed over back & fore rib	1/2 better balance, leaner, more style	1 shallow bodied, lacks finish
1/4 more style, trimmer, better balance, stronger topped, better muscle	4/1 more size and length	4 over finished, wasty brisket, rough shoulders

FIGURE 12-15

A sample set of notes for a class of crossbred market steers. Overall placing is shown at the top. Animal 3 was found to be the best in the class.

Presentation and Delivery Reasons are given in a logical order and should be well organized. Speak clearly and not too rapidly. Make sure to use proper grammar. When giving your reasons, stand 6 to 8 feet from the judge. Look the judge straight in the eye.

Hands are kept at the side or behind the back. Stand straight. Speak loud enough to be heard, but not too loud. Speak with confidence; do not hesitate. Make a concise final statement explaining why the animal at the bottom of the class was so placed. Only make statements that are true. Grant or admit the good qualities of the other animal in the pair.

Summary

Beef animals are selected mainly on the basis of conformation and performance records. An animal should produce the maximum amount of the high-priced cuts. The producer can select high-performing animals based on records of previous performance. Some traits are more heritable than others. Cattle producers can improve their beef herds by using the knowledge of heritability of traits, and selecting breeding animals on the basis of conformation and performance records.

Livestock judging events are important to the improvement of the beef industry. Beef animals are judged on the basis of their conformation. A good judge learns the parts of the animal and develops a logical system for evaluating the animal. The presentation of oral reasons by inexperienced students to an officiating judge provides an opportunity to explain why animals were placed in a given manner.

Quick Facts

- Selection is based primarily on conformation and performance records.
- Conformation refers to the appearance of the live animal. It includes the skeletal structure, muscling, fat balance, straightness of the animal's lines, and structural soundness.
- One of the best ways to select beef animals is on the basis of performance records, which include production testing, progeny testing, and performance testing.

- The selection of the herd bull is one of the most important decisions of the cattle producer.
- Sire summaries provide information on traits that are economically important to cattle producers.
- The ability of the sire to transmit genetic traits is defined in sire summaries as the Expected Progeny Difference (EPD).
- Judging beef animals consists of comparing one animal to another based on the conformation of the animals.
- A good livestock judge follows a definite procedure.
- The main points to look for in judging market classes are: (1) type, (2) muscling, (3) finish, (4) carcass merit, (5) yield, (6) quality, (7) balance, (8) style, and (9) smoothness.
- Breeding classes are judged for several traits in addition to those listed for market classes: (1) condition, (2) size, (3) feet, legs, and bone, (4) breed character, and (5) sex character.
- Oral reasons are given by a livestock judge to explain the differences between animals and to justify the reasoning used for assigning placings in judging.
- Notes on how a class is placed should be taken if oral reasons will be given.

In Perspective

Judging Livestock

by Jessica Fife



Delmar/Cengage Learning

FIGURE 12-16

Jessica Fife, high school livestock judging participant.

As a member of a livestock judging team, I have learned many life lessons and skills that I use on a daily basis. I grew up in the city in an urban area with no real livestock experience other than the occasional trip to the county fair. Lucky for me, experience was not required to be a judge.

As a member of the livestock judging team, we traveled to different parts of the region and state to judge livestock. One year, we won at the state level and were able to compete at the national level. We met many people in the industry and made many new friends from other schools.

In a livestock judging competition, we were given several classes of

four animals each to judge. We ranked those animals from most to least desirable according to various traits and conformation. After judging the animals, we supported our decision by giving oral reasons before a judge. Oral reasons are an explanation of your placings of the animals. This was difficult at first, because I had little public speaking experience. However, the more I practiced, the more comfortable I became defending my placings. I remembered what I learned in the classroom, and applied it to each set of animals I judged.

Some life skills I learned while judging livestock are:

- **Public speaking skills:** I learned to speak confidently and clearly to a judge when giving oral reasons.
- **Note-taking skills:** The notes I took had to be clear and to the point to help me give oral reasons.
- **Memorization skills:** I learned to quickly memorize my oral reasons and state them clearly, without notes, to a judge.
- **Decision-making skills:** I learned to make quick decisions based on a set of criteria.
- **Focus:** I learned to focus on what is important and recognize the finer details of a subject.
- **Teamwork:** Our team learned to support each other and learn from each other. We were all on different experience levels but we used that to our advantage.
- **Anatomy and Physiology:** I studied many species and became familiar with their anatomy and physiology, much of which applies to other animals as well as humans.
- **Self-confidence:** After giving oral reasons to a judge, my self-confidence grew when I realized that I could defend my opinions with solid statements of fact.
- **Team player:** I learned to support my team, even when we did not perform well.
- **Language skills:** When giving oral reasons, I learned to expand my vocabulary and use descriptive words when communicating my thoughts and opinions.

Student Learning Activities

1. Judge breeding and market classes of beef animals from pictures or live animals. Give oral reasons.
2. Take a field trip to a farm to observe the performance testing procedures being used.

3. Give an oral report to the class on various aspects of selecting beef cattle.
4. Evaluate pedigree information on several beef animals and select the most desirable animals.
5. When planning and conducting a beef animal supervised agricultural experience program, use all the appropriate criteria learned in this chapter to select animals.

Discussion Questions

1. Describe the kind of conformation that is considered desirable in beef cattle.
2. Why is selection of the herd bull so important to success in beef production?
3. Briefly describe the traits that are desirable in a beef bull.
4. Describe the differences between market and breeding classes.
5. Describe the grant/criticize format for oral reasons.

Review Questions

True/False

1. Beef animals are judged on the basis of their conformation.
2. The heritability of a trait is the degree to which the performance of the animal can be attributed to genetics.
3. Breeding animals and market animals are judged the same way.
4. There are 18 factors to consider when judging beef cattle.
5. Selecting good bulls can improve the overall score of the herd.

Multiple Choice

1. Quality grade refers to the amount of _____ and the carcass grade.
 - a. fat
 - b. marbling
 - c. muscle
 - d. bone
2. EPD stands for _____.
 - a. Expected Progeny Difference
 - b. Extruded Prolific Disease

- c. Expected Program Difference
- d. Experienced Progeny Difference
- 3. The _____ is a measurement based on observation and height measurements when calves are 205 days of age.
 - a. yield score
 - b. frame score
 - c. progeny testing
 - d. sire summary
- 4. A _____ is the record of the ancestors of an animal.
 - a. progeny test
 - b. sire summary
 - c. pedigree
 - d. bloodline
- 5. The judge should look at the _____, _____, and _____ to judge a show animal.
 - a. feet, legs, bone
 - b. side, front, rear
 - c. side, tail, ears
 - d. top, bottom, front

Completion

- 1. The use of high-frequency sound waves to measure fat thickness and the loin-eye area is called _____.
- 2. Sire summaries record data regarding the daughters of bulls. This information is referred to as the _____.
- 3. A _____ animal is an animal held for breeding.
- 4. _____, also known as finish, is the amount of fat cover on the animal.
- 5. Yield is the _____.

Short Answer

- 1. What does the acronym MBV stand for?
- 2. What is the value of performance testing?
- 3. What are the factors to consider when judging a market class? Explain what each means.
- 4. How does the sire summary help the producer in selecting a herd bull?
- 5. What should a producer look for when choosing a herd bull?



CHAPTER 13

Fitting and Showing Beef Cattle



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Develop a plan for training a beef calf for show.
- Explain how to prepare a beef calf for show.
- Describe how to show a beef calf.



KEY TERMS

halter breaking
rope halter

setting up
show stick

rinsing
ring steward

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Halter	Licou	Halfter	Capestro	El Cabestro
Hoof	Sabot	Huf	Zoccolo	La Pezuña
Calf	Veau	Kalb	Vitello	El Ternero
Rope	Corde	Seil	Corda	La Cuerda
Brush	Brosse	Pinself	Spazzola	El Cepillo

Training a Beef Calf for Show

After purchasing a beef calf, the work just begins. Time and effort must be put into training, grooming, and feeding. Some of the training includes halter breaking, leading, and using the show stick to set the animal.

Halter Breaking

A calf that is to be exhibited in a show must be halter broken. **Halter breaking**, the process of training an animal to be led by a halter, can be accomplished by many methods (Figure 13-1). The earlier the heifer or steer is halter broken, the safer for the exhibitor

halter breaking

the process of training an animal to be led on a halter



FIGURE 13-1

A properly fitting halter is important.

rope halter

two loops of rope, one placed over the nose and one placed behind the ears, used to restrain an animal

and the calf. The most common halter used for halter breaking is the rope halter. The **rope halter** generally consists of two loops, one over the nose and one behind the ears, which are used in restraining or leading an animal. The lead rope can either be made as part of the halter, or it can be a separate attachment to the halter.

Position the halter over the calf's head and make sure it is fitted properly. A properly fitted halter should fit snugly on the animal's head without being too tight. An exhibitor should be able to slide their fingers between the halter and the calf's head. The halter should be in good condition without fraying, and be able to restrain the calf from breaking loose. The halter should not block the eye nor protrude into the eye. A properly fitted halter will cause less stress on the animal and the handler. Some handlers will let the calf become accustomed to the halter and lead rope by allowing the rope to drag on the ground for a couple of days before working with the calf. If this method is used, make sure the halter is removed every evening and placed back on the calf the next morning. After the calf has learned not to fight and pull at the halter, it is time to train the calf to stand and to lead.

Training to Stand

The calf's halter may be tied to a sturdy post in order to teach the calf to stand or tie out. The post must be able to withstand pulling by the calf (Figure 13-2). Since calves will be tied out at the show, it is important for them to understand what is happening, and learn not to fight the halter. Tie the haltered calf to the post with its head held slightly up. This helps teach the calf how to stand in the show ring. This should be done every day, starting with tying the calf for about 10 minutes and working up to half an hour the first week. Do not leave the tied calf unattended. This is especially important for the first few times of tying.

Once the calf gets accustomed to being tied, slowly approach the calf and brush the calf around

FIGURE 13-2

Tying calves to a sturdy post or fence is a technique sometimes used in halter breaking.



Courtesy of Christy Bryan

the shoulder, back, and sides with a grooming brush. Approach the calf from the side to stay in the calf's line of sight.

Training to Lead

Do not attempt to lead a calf that is not already halter broken; this will encourage breakaways and make the training process harder. When teaching to lead, start off in an enclosed area with a space large enough to walk in (Figure 13-3). This area should not have enough space to allow the calf to pull away from the handler. With the halter on the calf, walk the animal around the enclosed area. To get the calf moving, apply slight forward pressure on the lead of the halter, and then loosen the pressure on the lead rope, allowing the calf to move forward. Do not apply continuous pressure or the calf will constantly fight the halter. Always pull on the halter and release the pressure when the calf responds. The calf will learn that the pressure on the halter loosens when it leads and then it will continue to lead.

Start leading the calf for at least ten minutes, slowly increasing the time the calf is led each day.



Courtesy of Christy Bryan

FIGURE 13-3

Calves can be stubborn about being led. Patience and time will make this job easier.

The longer the training time, the better the animal will behave in the show ring. When teaching to lead, *do not* do the following things:

- ◀ Tie the calf to any kind of motor vehicle.
- ◀ Jerk hard on the halter or lead rope.
- ◀ Use any kind of electrical shock or prod device.

When teaching the calf to lead *do* the following:

- ◀ Be patient with the calf.
- ◀ Spend time with the calf.
- ◀ Be calm and encourage the calf to cooperate.
- ◀ Practice, practice, practice.

Training for the Show Ring

Once the calf is trained to lead, the exhibitor can begin a daily routine with the calf. The calf needs to be tied for a short period of time and then moved through a show ring routine everyday. The show ring routine consists of walking, setting up, and teaching the calf how to move around the ring. The calf should be walked clockwise around the training area, as this is the movement it will probably take in an actual show ring. Stop periodically and set up the calf as if in a show ring.

**FIGURE 13-4**

A show stick is an essential piece of equipment to help set the calf up for show.

setting up

to position or pose an animal for display in a show

show stick

device with a small hook on one end that is used to set an animal up for show

**FIGURE 13-5**

Move to different locations as if in the show ring and practice setting the calf up.

Setting up means to position an animal in order to display and show the animal to its best advantage for the judge. To set up the calf, stop the calf by pulling up on the lead rope. At this point, the exhibitor will need to have a **show stick**. A show stick is an instrument that is used in the show ring to set up a calf for show, especially the feet and legs (Figure 13-4). The show stick can be used to gently push a foot back, or the hook at the bottom of the stick can be used to move the foot forward. Use the show stick to set up the front feet of the calf squarely.

Once the calf is set up, scratch the calf's belly, slow and steady, with the show stick as a reward and reminder to the calf to stand still. Each time the calf is stopped, the calf should be set up and trained to hold this position for 10–15 minutes (Figure 13-5). This should be done several times daily to build the stamina of the calf in the ring.

Preparations for the Show

The goal of all the training at home is to prepare to compete at the livestock show. Activities at the show can be noisy and stressful unless the exhibitor and animal are prepared. Having the show animal accustomed to washing, leading, tying, grooming, blocking, standing, and setting up will minimize stress on both the animal and the exhibitor.

FIGURE 13-6

Well-groomed animals are washed before show time.



Courtesy of Christy Bryan

Washing and Rinsing

Calves should be washed at home and also at the show. When washing the animal, use livestock shampoo and a brush to clean the animal (Figure 13-6). All dirt and debris should be removed. Make sure the calf is washed under the belly and around the flank, which are areas that are easily missed. When washing the calf's head, it is important to make sure that no water gets into the ears. The inside of the ears should be cleaned as well. Rubbing alcohol on a towel may be used to remove any wax buildup.

On days that calves are not washed with shampoo, the calves need to be rinsed. **Rinsing** is when calves are cleaned with water only. A brush can be used to help clean especially dirty areas. Rinsing and washing promote hair growth in warm weather by cooling the animal.

rinsing

cleaning an animal with only water

Brushing

Show calves should be brushed at least once a day with a soft brush (Figure 13-7). Brushing the calf every day keeps the buildup of dirt to a minimum. Brushing makes it easier to clip the animal, and it makes the hair coat look better when compared to calves that have not been brushed regularly. Extra brushing will pay off on show day.

FIGURE 13-7

Proper brushing techniques should be followed to make the calf's hair coat look its best.



Delmar/Cengage Learning

Trimming Feet

Properly trimmed hooves are important for a show animal. When the hooves get too long and are not shaped properly, the animal may not stand and walk correctly. The hooves should be trimmed during the early conditioning period. Make sure that feet are trimmed at least two weeks before the show. This will give the calf time to recover if the person trimming gets too close to the living tissue of the foot, which can cause the calf to limp. The trimming process needs to be done by someone who is experienced in hoof trimming.

Preparing for a Show

Checklist before the show:

- ▶ Make sure all entry forms are turned in to the appropriate authority.
- ▶ A health certificate from a veterinarian must accompany the show animal traveling to the show. A veterinarian will need to check the health of the animal and determine that the animal is in good health.
- ▶ Make sure you have all the paperwork needed for the animal (registration papers, health papers, etc.).



Courtesy of Sullivan Supplies, Inc.

FIGURE 13-8

A well-stocked show box is essential to preparing for the show.

- ▶ Check paperwork against the tattoo or ear tag to make sure that the animal is correctly identified.
- ▶ Be sure there is enough feed/hay for the animal.
- ▶ Be on time for the show.
- ▶ The following items should be in a show box (Figure 13-8):
 - Brushes, combs
 - Extension cords
 - Blow dryer
 - Towels
 - Extra rope halter
 - Tie-halter and neck rope for each animal
 - Clippers
 - Show halter
 - Show clothes
 - Show stick
 - Grooming aids
 - First aid kit

Other items that may be needed at the show include:

- ▶ Blocking chute
- ▶ Shovel
- ▶ Pitchfork
- ▶ Rake
- ▶ Broom
- ▶ Stall signs
- ▶ Feed
- ▶ Water and feed pans
- ▶ Fan

At a Show

Once at the show, the exhibitor should continue the work done at home. This includes practicing with the calf, walking, setting up, grooming, and exercising. A typical show day may begin at 6:00 A.M. and not end until 8:00 P.M. or later.

Guidelines for Clipping

All clipping should be done by someone knowledgeable about the current trends in the show ring. Some competitors hire professional handlers to clip their show animal, although many adult leaders insist the student do the clipping or at least play a major part in the procedure.

Show rules must be adhered to when clipping animals in preparation for showing. Some shows allow certain types of grooming and clipping, and others do not. Some general guidelines for clipping a show calf include:

- ▶ Before starting to clip the animal, the animal should be free of dirt and debris, which can dull the clippers and cause gaps or uneven areas in the clipped sections.
- ▶ The beef calf should be completely dry before clipping. A blow dryer may be used to dry the hair.
- ▶ The calf should be securely placed into a blocking chute (Figure 13-9). A blocking chute is generally a metal frame that is enclosed on all four sides. The frame on each side is moveable to allow for easy clipping access. This provides a safe enclosure for the exhibitor to clip the calf.

FIGURE 13-9

A blocking chute. The animal should be securely fastened into the chute.



Courtesy of Ray Herren

- ◀ Make sure to secure the calf's head in the blocking chute.
- ◀ Exhibitors should make sure that the clipping area is free of hazards, and position themselves to avoid being kicked or injured if the animal moves.

Showing Beef Cattle

The reward for all the hard work at home is the show ring. With practice and patience, this process becomes easier. Remember to learn from the judge's comments so improvements can be made for the next show. The exhibitor, parent, or teacher should try to write down the judge's criticisms and praises, so that those issues can be improved upon for the next show.

Inside the Show Ring

Before entering the show ring, the exhibitor and the calf should look their best. The exhibitor should be dressed in a clean shirt that is tucked into clean jeans or dress pants. A Western belt and boots are commonly worn. Hats and sunglasses are not appropriate clothing items for the show ring. The animal should be clean, dry, fitted, and controllable for the show (Figure 13-10). When entering the show ring, keep the animal's head held up with the right hand. The exhibitors generally lead their animals into the show ring single file, walking clockwise around the ring until the judge or **ring steward** instructs otherwise. The ring steward is the person assigned to help carry out the judge's instructions and assist with animal movement. The exhibitor and animals will usually be directed to line up head-to-tail to allow the judge to look at each animal's profile.

ring steward

person in a show ring that helps to carry out the judge's instructions and assist with animal movement

The judge will usually have the exhibitors lead their animals into a side-by-side position on the opposite side of the ring. After the judge has reviewed

FIGURE 13-10

A properly groomed show animal in the show ring.



Courtesy of Christy Bryan

the animals in this position from behind, they are asked to turn to the right and walk clockwise behind the other calves. Make sure to leave about one calf-length between calves in the show ring, leaving enough room for the exhibitor to reposition the calf in line if the need arises. The exhibitors may then be instructed to line up their animals in their original head-to-tail position, and will be pulled out of the lineup by the judge for class placement.

Exhibitors should follow some basic rules of conduct while in the show ring. These include no talking unless spoken to by the judge, and no excessive gesturing. This behavior can be distracting for the judge and ring staff. The exhibitor should observe and wait for the officials in the show ring to instruct the movements of the exhibitor and calf (Figure 13-11). Keeping an eye on the position of the judge helps the exhibitor to show the calf to the greatest advantage. This also allows the judge to give visual signals to the exhibitors when placing the calves.

Showmanship

A livestock show generally consists of two parts—showing of the animal and showmanship. In showmanship, the exhibitor is judged against other



FIGURE 13-11

Control of the animal is one skill evaluated in a showmanship class.

exhibitors. Showmanship classes are generally broken down by the exhibitor's age group. Exhibitors are judged on their ability to control the animal, their knowledge of the species, and related topics.

If the exhibitor is entering the showmanship contest, he or she should be prepared to answer some basic questions asked by the judge. Some basic questions include: What is the weight of your calf? When was your calf born? What is the breed of your calf? What is the sex of your calf? What do you think is the best quality of your calf? What are some weaknesses of your calf?

Other questions may come from the following areas:

- ▶ Qualities of the calf
- ▶ Internal/External parasites
- ▶ Breeds and genetics
- ▶ Identification
- ▶ Feeds and feeding
- ▶ Animal part identification
- ▶ Market identification
- ▶ Production

Summary

The first step in getting a calf ready to show is to train the calf. The training process involves haltering the calf, teaching the calf to lead, teaching the calf to pose, and preparing the calf for the ring. It is important to wash and brush the calf regularly. Washing and brushing will make clipping easier, and will improve the appearance of the calf in the show ring. Check the calf's hooves to see if they need trimming before the show. Hoof trimming should be done at least two weeks prior to the show date.

When preparing for a show day, the exhibitor should have a list of items that need to be taken to the show. When clipping for show day, it is important to understand how to properly clip, and to clip the animal in accordance with the show rules. It is helpful to have an experienced clipper and fitter help with this if the exhibitor is just learning how to clip. Once the calf is clipped and ready to show, it is the exhibitor's job to present the calf and him or herself to the judge. The judge is looking to see how well the exhibitor presents the calf. Showmanship is a skill that takes practice and experience. The exhibitor should be knowledgeable about the project, and be able to answer questions about the calf.

Quick Facts

- Training the calf at home helps the animal and the exhibitor to be more confident at shows.
- Training includes halter breaking, leading, and using the show stick to set the animal.
- When teaching the calf to lead, use pressure and release training instead of a constant pulling motion.
- A show stick is used to position the animal for best display to the judge.
- Proper grooming techniques to be followed include washing, rinsing, brushing, and hoof trimming.
- Experienced professionals should be on hand to trim the animal's hooves and to oversee the clipping of the animal with inexperienced exhibitors in position to observe and learn.
- The two competitions in a show are the showing of the animal and showmanship.
- The showmanship class is usually divided into age groups at shows.
- Making a list of items to take to the show makes packing less stressful for the exhibitor.

- Exhibitors should be ready to answer questions from the judge and follow the judge's or ring steward's directions.
- When training the calf, be patient, gentle, and calm.
- Time spent working with the calf at home will pay off in the show ring.

Student Learning Activities

1. If available, use student beef projects to demonstrate show techniques.
2. Watch a video about beef showing and discuss the techniques.
3. Have a local experienced exhibitor come in and speak about showing beef cattle.
4. Use the information given in this chapter when planning and participating in a beef supervised agricultural experience program.
5. Practice the movements in the show ring as described in the text.

Discussion Questions

1. What skills can an exhibitor gain from showing beef cattle?
2. Describe the different parts of training a show animal.
3. Why are washing and brushing the beef calf important for show day?
4. Discuss some needed items by an exhibitor at a show?
5. Discuss questions that might be asked during the showmanship competition.

Review Questions

True/False

1. The showman and the calf should be clean and ready upon entering the show ring.
2. When stopping the calf to set the feet up, stop the calf by pulling down on the halter lead.

3. The show stick is only used to scratch the belly.
4. The showman needs to pay close attention to the judge for instructions in the show ring.
5. The showman does not carry a show stick in the ring.

Multiple Choice

1. Which of the following should be brought to a show?
 - a. Show halter
 - b. Feed
 - c. Needed papers
 - d. All of the above
2. _____ should be done on a day that washing with soap is not done.
 - a. Hoof trimming
 - b. Rinsing
 - c. Clipping
 - d. Halter breaking
3. A _____ should be used when clipping the show calf.
 - a. working chute
 - b. round pen
 - c. tie out
 - d. blocking chute
4. _____ at home is imperative for a successful show experience.
 - a. Training and leading the calf
 - b. Mapping the calf's lineage
 - c. Allowing the calf to roam free
 - d. Letting the calf's hair grow long
5. _____ will help the hair to grow and give an advantage in the show ring.
 - a. Hoof trimming
 - b. Leading
 - c. Brushing
 - d. Showing

Completion

1. The _____ is used to set up the feet and to scratch the belly of the calf while standing in position in the show ring.
2. The exhibitor walks _____ (direction) around the ring.
3. Exhibitors should not wear _____ or _____ in the show ring.
4. Beef calves should be shown using a _____ halter.
5. _____ the calf every day keeps the build up of dirt to a minimum, makes it easier to clip the animal, and gives that calf a different appearance.

Short Answer

1. What are the steps to training a successful show calf?
2. How much space should you leave between the show animal and other beef calves in the show ring? Why?
3. Describe the appearance of the exhibitor and animal as they enter the show ring.
4. What happens in the show ring?
5. Explain the general guidelines for clipping a show calf.



Section 5

SWINE

CHAPTER 14 Introduction to Swine Production

CHAPTER 15 Management of Swine

CHAPTER 16 Selecting and Judging Swine

CHAPTER 17 Fitting and Showing Swine

FFA AND 4-H CONNECTION

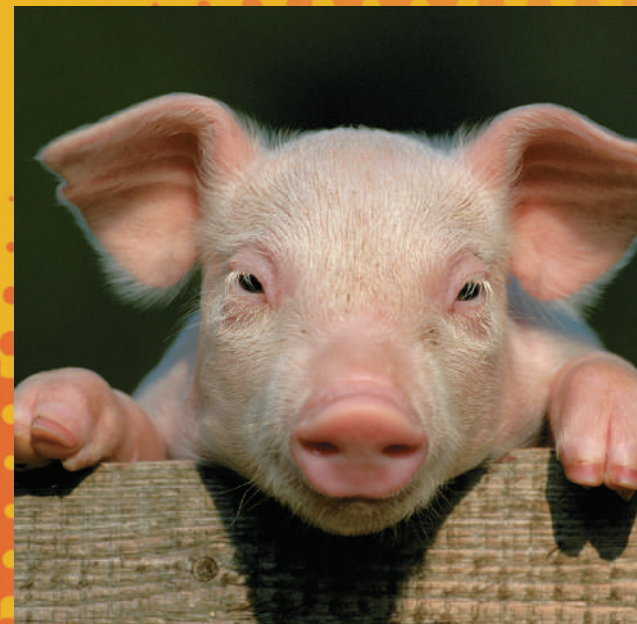


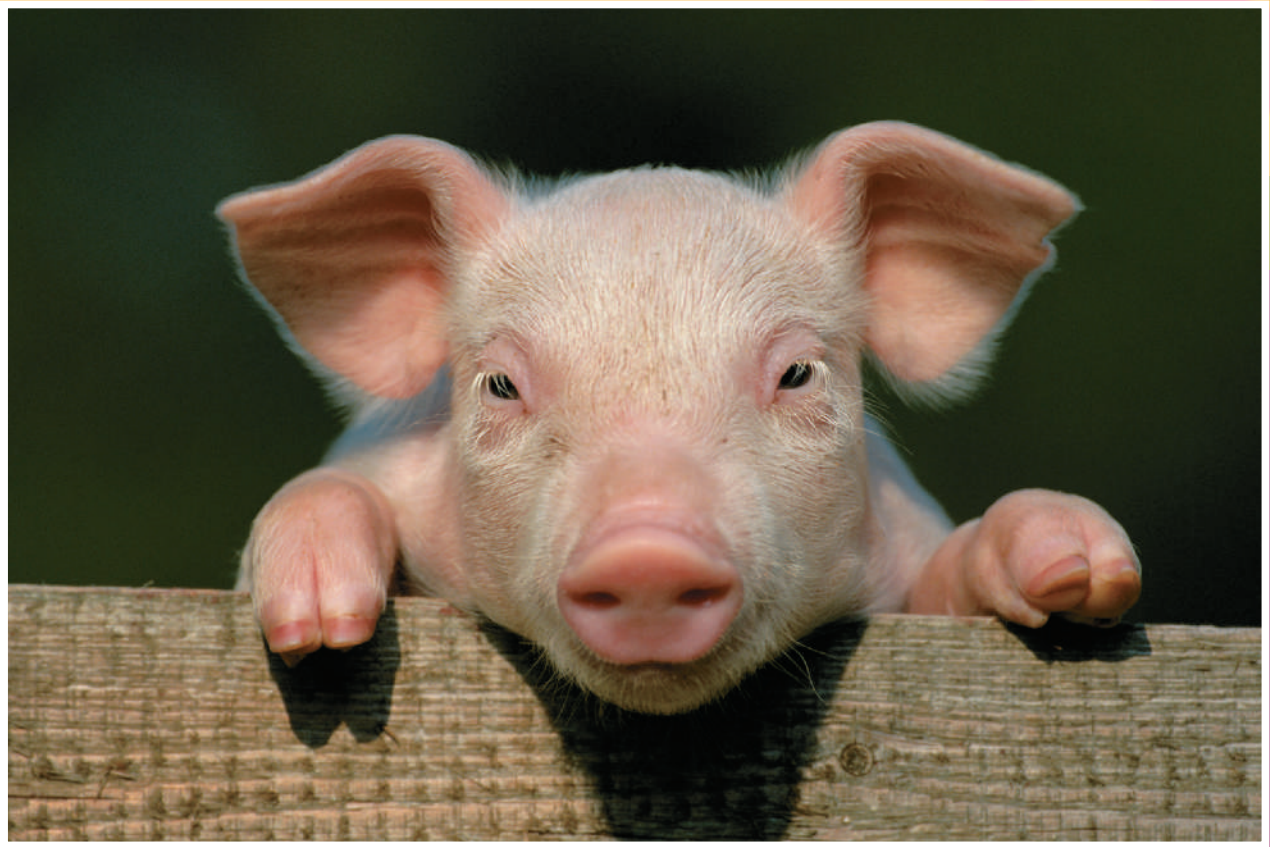
The following is a partial list of activities in which a student may participate using knowledge obtained in a swine program. Students should consult local and state youth organizations, such as the National FFA Organization and 4-H, to determine which livestock-related programs are available in their area.

- Agricultural Marketing
- Agricultural Sales
- Agriscience Fairs
- Animal Nutrition
- Food Science and Technology
- Livestock Evaluation Events
- Livestock Shows
- Meats Evaluation and Technology

Proficiency Awards (FFA)

- Diversified Agricultural Production
- Diversified Livestock Production
- Swine Production
- Veterinary Medicine





CHAPTER 14

Introduction to Swine Production



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe the modern swine industry.
- Identify trends in the swine industry.
- Identify characteristics of the major breeds of swine.



KEY TERMS

barrow
gilt
sow
boar
stag
vertical
integration

seedstock
commercial
swine
purebred swine
feeder pig
producer

finishing
operation
farrow-to-finish
farrow

LANGUAGE CONNECTION

English	French	German	Latin	Spanish
Hog	Porc	Schwein	Porcinus	El Cerdo
Pig	Porc	Schwein	Porcus	El Cerdo
Swine	Porc	Schwein	Suis	La Porcina

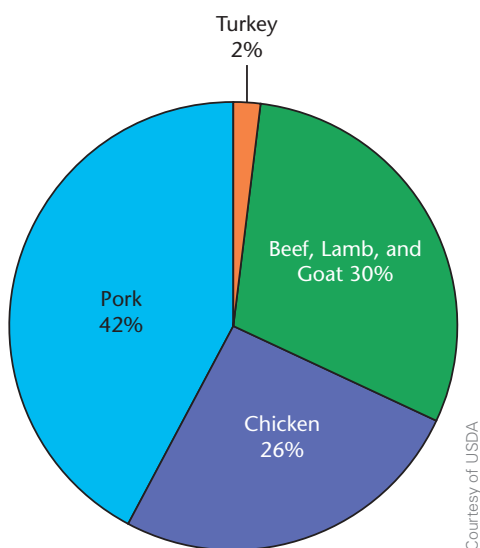
Overview of the Swine Industry

Raising swine is a popular farm enterprise because the return on investment is generally faster than many other livestock enterprises; investment can be low, and facilities can be minimal. However, most modern swine operations have large facilities that require high investment.

Hogs are efficient converters of feed to meat, requiring about three pounds of feed per pound of gain. A hog can be marketed at about six months of age, at a weight of 250–280 pounds.

Pork is the most widely eaten meat in the world (Figure 14-1). Swine ranks fourth in livestock value in the United States. China both produces and consumes the most pork. The United States ranks third in world pork production, and is the second largest consumer of pork. Americans eat approximately 64 pounds of pork per year.

The swine industry has made great strides in increasing production in recent years, thanks to technology and genetic improvement. Today, more pigs are weaned per litter and they reach market size quicker with improved feed efficiency than in the past. The average number of pigs weaned per litter is now over 9.5 pigs, as compared to about seven pigs in 1978. Swine breeding companies specialize in genetic improvement, and provide superior lines of breeding stock. Improved genetics accounts for the majority of the improvements in modern swine production.



Courtesy of USDA

FIGURE 14-1

Pork is the number one meat consumed in the world.



Courtesy of Doug Wilson, USDA

FIGURE 14-2

Most hogs are raised in the Midwest where corn is plentiful.

A hog production business is generally more profitable if it is located near the feed source, avoiding expensive transportation costs of moving feed long distances. By far, corn makes up the majority of swine feeds (Figure 14-2). Soybean meal is the second-most widely used ingredient for protein. The Corn Belt states have developed into the center of the swine production industry in the United States because they produce the most corn and soybeans. About 70 percent of all swine in the United States are raised in the Corn Belt. The top five states in hog production are Iowa, North Carolina, Minnesota, Illinois, and Indiana. Of these, only North Carolina is not a Corn Belt state.



History Connection

Cincinnati, Ohio was once known as “Porkopolis.” As a large city in the Corn Belt, Cincinnati became the pork processing center of the United States in the 1820s. Cincinnati had easy access to river transportation and was surrounded by productive farmland. The title of Porkopolis was short-lived for Cincinnati, as Chicago replaced Cincinnati in the 1860s as the leading pork processing center. Transportation of pork to distant cities from Cincinnati was made possible before the days of refrigeration because pork was cured at that time with salt. Salt pork became a staple in the U.S. diet because it did not readily spoil at room temperature.

barrow

a male pig that was castrated before sexual maturity

gilt

a young female pig that has not yet given birth and is not showing signs of pregnancy

sow

a female pig that has given birth (farrowed) or is showing signs of pregnancy

boar

a male pig that has not been castrated

stag

a male pig that was castrated after reaching sexual maturity

Classification of Swine

Swine are classified according to sex and reproductive status, which affects how they are managed, fed, housed, and marketed. The five classes are:

- ◀ **Barrow** – a male pig that was castrated before sexual maturity
- ◀ **Gilt** – a young female pig that has not yet given birth and is not showing signs of pregnancy
- ◀ **Sow** – a female pig that has given birth (farrowed) or is showing signs of pregnancy
- ◀ **Boar** – a male pig that has not been castrated
- ◀ **Stag** – a male pig that was castrated after reaching sexual maturity

Trends in the Swine Industry

The swine industry has changed rapidly in recent years, and continues to evolve. Changes include improved genetics, contract production, fewer swine farms and larger swine operations with more hogs produced per farm, and more mechanization for reduced labor costs.

Most hogs are produced on large farms in confinement housing (barns). Residents and legislatures

of swine-producing states are concerned about the environmental impact of large swine operations. Some states have passed or have considered passing legislation to limit the size of swine operations.



Science Connection

Hogs are extremely intelligent animals (Figure 14-3). They are smarter than dogs or cats, and some scientists believe they are smarter than 3-year-old human children. Tests were done where pigs were taught the meaning of simple words and phrases. Several years later, the instructions were repeated, and the pigs still remembered what to do. The same thing was done with different objects placed in front of them. They were taught to jump over, sit by, or retrieve the item. Three years later, they could still distinguish between the items.

The 10 smartest animals on the planet according to Animal Planet:

1. Chimpanzee
2. Dolphin
3. Orangutan
4. Elephant
5. Crow
6. **PIG**
7. Squirrel
8. Pigeon
9. Octopus
10. Rat

Courtesy of <http://animal.discovery.com>

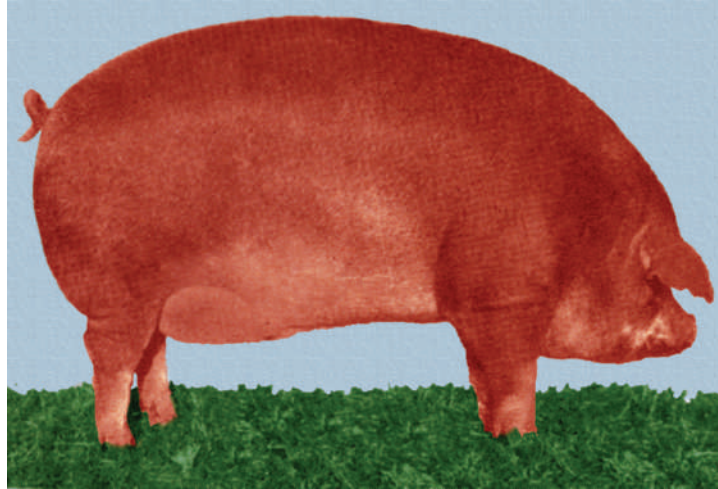
FIGURE 14-3

The 10 smartest animals.

Hogs were traditionally raised for lard. Until the last few decades, fat hogs were highly prized for lard production (Figure 14-4). Modern hogs have radically different body characteristics than their ancestors (Figure 14-5). The transformation of hogs from a “fatty” animal to a lean animal came about because of changes in the American diet. In recent years, Americans have become more health-conscious because of increased concerns about obesity and other health problems. The demand for leaner, healthier meat helped to drive the market to produce lean hogs.

FIGURE 14-4

Until the mid-1950s, extremely fat “lard type” pigs were produced because of the need for lard, especially for cooking and soap making. Lard was also used as a source of nitroglycerine in explosives. During World War II, the price of lard was higher than the price of ham.



Drawing courtesy of Randy Glance

FIGURE 14-5

A modern-type hog. Notice the muscling, leanness, and body capacity of this animal.



Courtesy of Ray V. Herren



History Connection

In the 19th century, hog fat was made into lard in North America and Europe. Lard was sometimes called the cook’s best friend. It has a number of qualities that make it ideal for frying and other uses in cooking. Due to its high saturated fat content, lard has fallen out of favor for health reasons, being replaced with vegetable oils by the late 20th century.

vertical integration

the practice of one company owning more than one operation that is part of the overall production of an item; this can include the production, processing, and/or distribution of the item

A major change in the swine industry has been the rapid growth of larger farms and **vertical integration**. A company that owns the grocery store that sells the pork, the pork processing plant, and the

swine farm is an example of a vertically integrated company. It is expected that vertical integration will continue to grow in the swine industry, and that the largest companies will supply a larger percentage of pork in the United States.

Contract production is gaining in popularity in the swine industry. In contract production, companies obtain an agreement with farmers to raise hogs for their company at a set price. The contracting company may provide any or all of the following: the feeder pigs or sows, feed, veterinary care, management services, and funding for the operation. The contractor, typically a family farmer, provides the labor, facilities, and day-to-day management.

Types of Swine Production

There are two major types of swine production systems: purebred and commercial. Producers in the purebred industry maintain the pure breeds that will be discussed later in this chapter. Purebred pigs may be registered with their breed association if specific requirements are met. Purebreds have traditionally served as the **seedstock** of the commercial swine industry. However, purebreds are being used increasingly less in commercial operations, as most producers now obtain their breeding stock through genetic specialty companies.

Commercial swine are raised for pork production, while purebreds make up a very small percentage of the U.S. pig population. Purebred producers serve an important role in maintaining a diverse genetic pool for the swine industry.

A major development in the swine industry has been the division of the show pig industry and the commercial swine industry. The show pig industry mostly showcases purebreds and purebred crosses, while most modern commercial market hogs are produced from genetic lines of pigs marketed by genetic specialty companies (Figure 14-6). The purpose

seedstock

animals held for breeding to supply pigs for market

commercial swine

swine raised for the production of pork

FIGURE 14-6

Show pigs may be purebred or crossbred.



Courtesy of Kayla Calhoun

of swine shows is to select pigs that represent the type of swine that should be produced in the industry. Winners are selected by swine experts (judges) who, in effect, are predicting the future direction of the industry. It is important to understand that desirable swine types change over time, and are changing at an increasing rate. With this in mind, sometimes it is found that the qualities in show pigs that make them winners in the FFA and 4-H show ring are not the same qualities desired by packing plants, producers, or consumers.

Commercial production systems can be further divided into three systems: feeder pig production; feeder pig finishing; and farrow-to-finish operations.

Purebred Swine Production

purebred swine

an animal belonging to one of the recognized breeds of swine that may be eligible for registration with the official breed registry

Purebred swine producers maintain the genetic purity of a particular breed. Less than 1 percent of the total hogs raised in the United States are registered purebreds. Purebred production requires more labor and record keeping than commercial hog production. The purebred producer must carefully record ancestry, breeding, and farrowing dates. Purebred producers also spend a great deal of time advertising, showing, and promoting their breed.

Purebred animals provided the foundation genetics used in commercial hog production. Many of the early genetic improvements in swine came from the work of purebred producers. Today, purebreds are popular for use in youth swine projects, such as FFA and 4-H.

Commercial Production

Most of the pork produced in the United States is produced in large operations. The goal of commercial producers is to produce pork for human consumption. Most commercial hog producers use a crossbreeding system. Today, most improvement in swine genetics comes from large swine seedstock companies. These companies have developed their own lines of breeding stock. Seedstock companies crossbreed hogs for the best genetics, regardless of breed. These lines of pigs are not purebreds, although the foundation genetics were derived from the purebred breeds. An example is crossing a Chester White, a breed known to have large litters and good mothering ability, with a Spot, a breed known for its high growth rate. This would produce a sow with large litters, good mothering ability, and whose piglets would have a high rate of growth. Almost all commercial lines are white pigs. White pigs are preferred and sometimes required at packing plants because the white skin and hair is easier to process in the scalding and hair removal process. Consumers sometimes reject pork if there is color to the hair follicles or skin that makes the meat look dirty or spoiled. The Duroc, a traditional red breed, has been crossed with white breeds in recent years to produce a breed called the White Duroc, in order to be more acceptable to the consumer.

feeder pig producer

an operator that produces and sells young pigs to finishing operations

Feeder Pig Producers A **feeder pig producer** manages large numbers of sows to raise many pigs that will be sold (Figure 14-7). They breed, farrow, wean, and then sell pigs to finishing operations. The goal of the producer is to raise a high-producing

FIGURE 14-7

Feeder pig producers strive to market pigs that are a uniform size and weight.



Courtesy of Excel Co-Op, Inc.

finishing operation

an operation where feeder pigs are raised to market weight

farrow-to-finish

an operation in which the sows give birth to pigs that are then raised to market weight

farrow

the act of giving birth to a litter of pigs

pig to be grown to harvest weight by finishing operations. Feeder pigs are generally marketed at eight weeks of age, and weigh about 40 pounds (18.2 kg).

Finishing Operations In a feeder pig **finishing operation**, the producer buys feeder pigs and feeds them so that they grow to market weight, about 250–280 pounds (113–127 kg). Finishing requires large amounts of feed over about a four-month period (Figure 14-8).

Farrow-to-Finish Operations **Farrow-to-finish** operators breed sows, **farrow**, and then feed the pigs to market weight. Some farmers have

FIGURE 14-8

Pigs on the finishing floor. Pigs are generally harvested between 250–280 pounds.



Courtesy of Chore-Time Systems, Milford, Indiana

farrow-to-finish enterprises on single farms. However, since the 1990s the trend has been toward more specialized forms of production. Different phases of production are often at different sites because diseases are easily spread from older hogs to the young pigs. Swine are bred and farrowed at one site. Then the young pigs are moved to a finishing facility at a different site. Keeping the production phases separate helps control disease transmission.

Housing Systems

Swine production can be described by the type of housing used. Pasture systems and total confinement systems are two main types. Historically, pigs were raised in pasture systems with minimal housing. By far, confinement systems are the most common today, consisting of many pens inside of large confinement buildings.

Some of the positive characteristics of a pasture management system are easy disposal of manure and low investment in housing. Hogs are rarely grown on pasture anymore, but niche markets for this type of production are developing due to the concern for animal welfare and the demand for organic and all-natural pork (Figure 14-9).



FIGURE 14-9

Some pigs are raised on pasture. Demand for pork produced on pasture and organic pork is increasing.

FIGURE 14-10

Most pigs are raised in confinement facilities.



Courtesy of Excel Co-Op, Inc.

Confinement systems are highly automated. Raising pigs in confinement usually requires a high investment in buildings and equipment, but the labor requirement is reduced. Today, almost all hogs are raised in confinement facilities (Figure 14-10).

Swine Breeds

Swine producers want pigs that have rapid, efficient growth and yield a high percent of meat. Various important traits are different among the breeds. Economically important traits include litter size, growth rate, feed efficiency, carcass length, leanness, and muscling.

Like most animal breeds, swine breeds were developed for specific purposes. It is important to understand the characteristics of each breed. For example, Yorkshire sows are known for large litters and good mothering abilities. This makes the Yorkshire sow very desirable in crossbreeding programs.

American Landrace

The Landrace breed originated in Denmark. The first Landrace hogs were imported into the United States in 1934. Landrace hogs are white, long bodied, and their ears lop forward and down. This breed is known to cross well with other breeds. Landrace

FIGURE 14-11

Landrace gilt. The Landrace breed is known for its exceptional mothering ability.



Courtesy of Mapes Livestock Photos

sows farrow large pigs in large litters and are exceptionally heavy milkers. Landrace genetics are a part of most American sow herds (Figure 14-11).

Landrace	
Origin	Denmark
Brought to U.S.	1934
Color	White
Characteristics	Long bodied, lop-eared

Berkshire

The Berkshire breed originated in England in the 1700s. Berkshires were imported to the United States in 1823. The Berkshire is a medium-sized hog that produces an excellent quality carcass. Berkshires are black with six white points: four on the feet and two on the face and tail. The head is slightly dished (concave), and the ears are erect (Figure 14-12).

Berkshire	
Origin	England
Brought to U.S.	1823
Color	Black with six white points
Characteristics	Excellent carcass, medium sized

FIGURE 14-12

Berkshire gilt. The Berkshire breed produces a high-quality carcass.



Courtesy of Mapes Livestock Photos

Chester White

The Chester White is an American breed. It originated in Chester County, Pennsylvania about 1815. The breed is named for the county of its origin. Chester Whites have ears that droop forward, and are noted for their mothering ability (Figure 14-13).

Chester Whites	
Origin	United States, 1815
Color	White
Characteristics	Drooped ears; noted for mothering ability

FIGURE 14-13

Chester White gilt. Chester Whites were developed in the United States.



Courtesy of Mapes Livestock Photos

Duroc

The Duroc breed originated from red hogs raised in the Eastern United States before 1865. This breed constitutes the second-most recorded breed of swine in the United States. The New Jersey red hogs were called Jersey Reds. The New York red hogs were called Durocs. The Jersey Reds and the New York Durocs were bred in the 1830s and became what we know today as the Duroc. At first, they were called “Duroc-Jersey,” but later, the “Jersey” portion of the name was dropped. Some Red Berkshires from Connecticut are also thought to have been included in the early breeding (Figure 14-14).

Durocs are red with shades from light to dark. A medium cherry-red is the preferred color. The Duroc has ears that droop forward. They have a good mothering ability, growth rate, and feed conversion.

Duroc	
Origin	Eastern United States, 1865
Color	Red (light to dark shades)
Characteristics	Drooped ears; good mothering ability, growth rate, and feed conversion



FIGURE 14-14

Duroc boar. Durocs are known for their superior growth rate and feed conversion.

Courtesy of the National Swine Registry

FIGURE 14-15

Hampshire gilt. Hampshires are used in many crossbreeding programs.



Courtesy of Mapes Livestock Photos

Hampshire

The Hampshire breed originated in England. These pigs were first imported into the United States between 1825 and 1835. The Hampshire is black with a white belt that encircles the forepart of the body and includes the forelegs. They have erect ears. The breed is noted for its foraging ability, muscling, and carcass leanness. Hampshires are popular and are used in many crossbreeding programs (Figure 14-15).

Hampshire	
Origin	England
Brought to U.S.	1825 through 1835
Color	Black with white belt
Characteristics	Erect ears; noted for foraging ability, muscling, and lean carcass

Hereford

The Hereford breed was developed in Missouri, Iowa, and Nebraska from 1902 to 1925. Foundation stock used in the development of the breed included the Duroc and Poland China. Chester White and Hampshire hogs may also have been included in the early breeding.

FIGURE 14-16

Hereford boar. Herefords are known to be exceptional producers.



Courtesy of Mapes Livestock Photos

Herefords are red with a white face. The red shade may vary from light to dark, but a deep red color is preferred (Figure 14-16). Among the qualifications to be registered, Herefords must have at least two white feet, and the white must rise above the hoof by at least one inch. The ears droop forward. Herefords are highly productive and are good mothers.

Hereford	
Origin	Missouri, Iowa, Nebraska, 1902–1925
Color	Red with a white face
Characteristics	Drooped ears; highly productive and good mothers

Poland China

The Poland China breed was developed in Ohio between 1800 and 1850. The Poland China hog is black with six white points, found on all four feet, the face, and the tip of the tail (Figure 14-17). The Poland China has forward-drooping ears. It has a big body frame and is one of the largest hog breeds.

Poland China	
Origin	Ohio, 1800–1850
Color	Black with white points
Characteristics	One of the largest swine breeds

FIGURE 14-17

Poland China gilt. The Poland China is a breed that has one of the largest body sizes of all swine breeds.



Courtesy of Mapes Livestock Photos

FIGURE 14-18

Spotted gilt. Spots are large-framed hogs with good muscling.



Courtesy of Mapes Livestock Photos

Spots

The Spotted swine breed was created in Indiana by crossing Poland China hogs with spotted hogs being grown in the area. Later crosses were made with Gloucester Old Spots, an English breed that is predominantly white with black spots.

The Spotted breed is black and white (Figure 14-18). In body type, the Spots are similar to the

Poland China. Spots have forward-drooping ears, and are large-framed hogs with good muscling and good meat quality.

Spots	
Origin	Indiana
Color	Black and white spots
Characteristics	Drooping ears; large framed with good muscling and meat quality

Tamworth

The Tamworth breed originated in Ireland. The Tamworth is one of the oldest of the purebred breeds. Development of the breed took place in England, and pure breeding began in the early 1800s. In 1865, the Tamworths achieved breed recognition by the English. They were first imported into the United States in 1881.

The Tamworth is red with erect ears and a long head and snout (Figure 14-19). The sows are good mothers and have large litters. Tamworths are noted for their foraging ability.

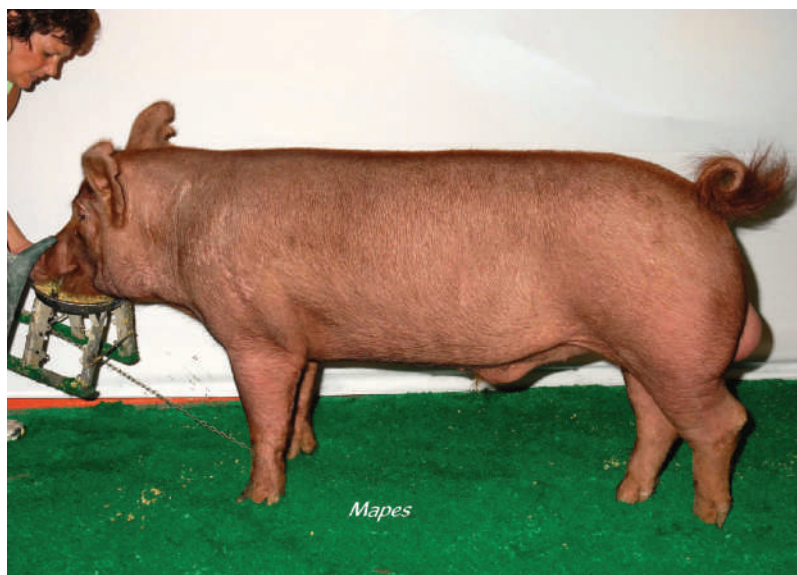


FIGURE 14-19

Tamworth boar. Tamworths are good foragers.

Tamworth	
Origin	Ireland
Brought to U.S.	1881
Color	Red
Characteristics	Erect ears with a long head and snout; good foragers and known as good mothers with large litters

Yorkshire

The Yorkshire breed originated in England in Yorkshire County. In England, the breed is known as the Large White. The United States imported Yorkshires in the 1800s. Yorkshires have the highest number of registrations in the United States and Canada.

Yorkshires are white with erect ears and a slightly dished face (Figure 14-20). The Yorkshire was one of the early hog breeds used for bacon. Yorkshires have large litters, excellent feed efficiency, rapid growth, good mothering ability, and long carcasses. Because of these desirable traits, they are commonly used in crossbreeding programs. Yorkshire genetics are a part of practically all commercial lines of pigs raised in the United States.



Courtesy of the National Swine Registry

FIGURE 14-20

Yorkshire boar. Yorkshires are included in most crossbreeding programs because of their large litters and other desirable qualities.

Yorkshire	
Origin	Yorkshire County in England
Brought to U.S.	1800s
Color	White
Characteristics	Erect ears; many desirable traits such as long carcasses, large litters, rapid growth, and mothering ability.

Chinese Pigs

Several Chinese swine breeds are of interest to American breeders, primarily for large litter sizes. Among the most prolific of swine breeds is the Chinese breed Meishan (Figure 14-21). This breed averages 15 live pigs per litter. Chinese breeds are inferior to American breeds in carcass quality, feed efficiency, and rate of gain. It is hoped that through breeding programs, the trait for large litter size can be successfully transferred to American breeds that will keep their desirable qualities.



Courtesy of USDA. Photo by Keith Weller

FIGURE 14-21
Meishan pigs are known for large litter sizes, averaging 15 pigs per litter.

Meishan	
Origin	China
Brought to U.S.	1989
Color	Grey
Characteristics	Wrinkled face and skin; known for very large litters; inferior in most traits compared to U.S. breeds

Summary

Most pork is produced on large farms in highly automated, confinement facilities. The Corn Belt states produce the most swine because they grow large amounts of corn and soybeans, the major feedstuffs used in swine rations.

The overall trend in the hog industry has been toward larger swine operations. The number of swine farms is decreasing, but the size of swine farms is increasing. Contract agreements between large corporations and producers are becoming more common. Swine production in the United States has made great strides in the past few years, especially in swine genetics.

Selection of swine breeds or genetic lines to use in crossbreeding programs is based on litter size, growth rate, feed efficiency, carcass length, leanness, and muscling. Most foundation stock for commercial swine producers is obtained from specialty genetics companies.

Several swine breeds were developed in the United States; others were developed in Europe. Standards for registration of the individual breeds are set by the breed associations.

Quick Facts

- Hogs rank fourth in livestock receipts in the United States.
- About 70 percent of all swine raised in the United States are produced in the Corn Belt states.
- There is an ongoing trend in the hog industry toward larger, automated, confinement swine operations.
- Contracting agreements between large swine companies and producers are becoming more common.
- The goal of the swine producer is to raise market pigs that have rapid, efficient growth, and a high yield of meat.
- Most breeds of swine used in the United States today originated either in the United States or in England.
- Hogs are efficient converters of feed to meat.
- Hogs can be marketed at about six months of age at a weight of 250–280 pounds.
- Pork is the most widely consumed meat in the world.
- China both produces and consumes the most pork.
- The United States ranks third in world pork production, and is the second largest consumer of pork.
- The average number of pigs weaned per litter is now over 9.5 pigs.
- Improved genetics accounts for the majority of improvements in modern swine production.
- Corn makes up the majority of swine feeds; soybean meal is the second-most commonly used ingredient.

- Trends include improved genetics, contract production, fewer swine farms, and larger swine operations with more hogs produced per farm.
- Pasture systems and total confinement systems are the two main types of swine housing.
- Hogs are extremely intelligent animals, smarter than dogs or cats.
- Until the last few decades, fat hogs were highly prized for lard production.
- Modern hogs have radically different body characteristics than their ancestors.
- The demand for leaner, healthier meat has helped to drive the market to produce lean hogs.
- Vertical integration is the practice of one company owning more than one operation that is a part of the overall production of an item.
- There are two major types of swine production systems: purebred and commercial.
- The purpose of swine shows is to select pigs that represent the type of swine that should be produced in the industry.
- Commercial production systems feeder pig production, finishing operations, and farrow-to-finish operations.
- Purebred animals provided the foundation genetics used in commercial hog production.
- Important traits of swine breeds include litter size, growth rate, feed efficiency, carcass length, leanness, and muscling.
- Chinese swine breeds have many traits that are inferior to American swine, but they are of interest to American breeders because of their large litter sizes.

Student Learning Activities

1. Prepare a chart of swine breed facts to help compare breed characteristics.
2. Conduct a field trip to a swine farm, or view a video on swine farming.
3. Ask a swine producer to talk to the class about his or her operation.
4. Consult the National Pork Board for more information on the swine industry.
5. Prepare a U.S. map indicating the top swine-producing states.

Discussion Questions

1. What advantages do the Midwestern states have in swine production?
2. Explain vertical integration and how it affects the swine industry.
3. Why are very large, confinement swine operations often unpopular with the public?
4. What are the most desirable qualities in a swine breed?
5. Discuss the major types of swine operations.

Review Questions

True/False

1. Purebreds provided the foundation genetics used to establish commercial lines of pigs.
2. Most of the hogs raised in the United States today are registered purebreds.
3. The Hampshire breed is black with a white belt that encircles the front part of the body.
4. The average number of pigs weaned per litter is 6.5.
5. There is an ongoing trend in the hog industry toward smaller farms.

Multiple Choice

1. A _____ is a male swine that was castrated while young.
 - a. sow
 - b. boar
 - c. barrow
 - d. stag
2. The average number of pigs weaned per litter is now over _____ pigs.
 - a. 10
 - b. 11
 - c. 9.5
 - d. 8

3. The _____ breed is red in color without white markings.
 - a. Duroc
 - b. Yorkshire
 - c. Chester White
 - d. Hampshire
4. Which of the following breeds originated in the United States?
 - a. Berkshire
 - b. Poland China
 - c. Yorkshire
 - d. Tamworth
5. Which of the following is not a type of swine production system?
 - a. finish-to-market operation
 - b. wean-to-finish operation
 - c. feeder pig operation
 - d. farrow-to-finish operation

Completion

1. The _____ breed is known for its excellent carcass quality.
2. The _____ is white with upright ears.
3. The _____ is red with a white face and at least two white feet.
4. If a company owns the feed mill, pig farm, and processing plant, it is said to be _____ integrated.
5. The _____ management system is the most common among commercial producers of pork.

Short Answer

1. Why are Chinese pig breeds being used in research to improve American breeds?
2. Why were very fat pigs prized at one time in the United States?
3. What are the advantages and disadvantages of breeding purebred hogs?
4. Name four swine breeds and the major advantage of each breed.
5. What was the origin of the foundation genetics used in commercial lines of pigs produced today?



CHAPTER 15

Management of Swine



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Discuss breeding and farrowing management of swine.
- Explain swine feeding management.
- Describe the housing and equipment needs for swine operations.
- Describe diseases and parasites of swine.
- Describe how swine is marketed.
- Discuss the merits of the Pork Quality Assurance Plus Program (PQA Plus).



KEY TERMS

feed efficiency
hybrid vigor
heterosis
estrous cycle
heat
colostrum
navel cord
tail docking
anemia

castrate
boar taint
creep feed
all-in/all-out
monogastric
withdrawal time
flushing
split-sex feeding
lagoon

gestation crates
zoonotic disease
mange
porcine stress
syndrome (PSS)
genetic disorder
Pork Quality
Assurance Plus
Program (PQA
Plus)

LANGUAGE CONNECTION

English	French	German	Latin	Spanish
Barrow	Brouette	Schubkarren	Majalis	El Cerdo Castrado
Boar	Verrat	Wildschwein	Verres	El Verraco
Farrow	Farrow	Werfen	N/A	Parir a Los Cerdos
Litter	Litière	Wurf	Foetus	La Camada
Sow	Truie	Sau	Porca	La Marrana
Wean	Sevrer	Entwöhnen	Depellere	Destetar

feed efficiency

the ratio of pounds of feed consumed per pound of weight gained

Management of Swine

Efficient management is the key to profitability in the swine enterprise. Swine management and production phases include breeding, gestation, farrowing, and finishing. The two factors that have the most influence on profitability in swine production are the number of pigs weaned per sow per year, and **feed efficiency**. Management of the breeding, gestation, and farrowing phases has a direct effect on the number of pigs weaned, and management during the finishing phase influences feed efficiency.



Delmar/Cengage Learning

FIGURE 15-1

To be profitable, sows must produce large litters.

Breeding and Farrowing Management

Reproduction is the first step to productivity in any livestock operation, and especially in swine. The number of pigs born and weaned per sow is vitally important (Figure 15-1). An operation that falls below the industry average of 9.5 pigs weaned per litter will certainly have a more difficult time remaining profitable compared to a farm that weans 10 or more pigs per litter.

Artificial insemination (AI) is being used more in swine production, especially on larger farms. Some advantages of artificial insemination are that it allows the producer to bring better genetics into the herd quickly, it reduces the risk of disease

transmission, and the cost and problems associated with keeping boars is eliminated. Natural mating of boars and sows is still common with smaller herds.

Breeding and Gestation

hybrid vigor or heterosis

improvement in traits in offspring over the traits of the parents

estrous cycle

the reproductive cycle in most mammals that is measured from the beginning of one heat cycle to the beginning of the next

heat

the period of time the female animal is receptive to the male animal for breeding

Crossbreeding market hogs is a recommended practice. Crossbred pigs exhibit **hybrid vigor** or **heterosis**. Heterosis is an improvement in offspring over the parents that results from crossbreeding. Crossbred pigs generally grow faster and use feed more efficiently. Crossbred sows usually have larger litters, are better mothers, and are generally healthier.

The **estrous cycle** in the pig averages 21 days. For 2–3 days during a 21-day period, the sow will stand for the boar to mount and breed her. During this 2–3 day period, sows are said to be in **heat**. Heat detection is very important in making sure the sows are bred as soon as possible.

Gilts should be bred when they are seven to eight months of age, and weigh 250–300 pounds (113–136 kg). Gilts have larger litters if they are bred during their second heat period rather than during their first heat period. The gestation period for sows is 113 days. An easier way to remember this time period is: three months, three weeks, and three days.

Farrowing

Sows should be moved into farrowing crates one to four days before they are due to farrow. The facilities should be clean and disinfected before sows are placed in them. Sows should be washed before they are put in farrowing crates to reduce the chance of disease transmission to the pigs.

Changes in the behavior of a pregnant sow are a good indicator that she is about to farrow. Sows usually give birth within about six hours after they begin a period of restless activity. Restless behavior includes standing up and lying down often, and rooting and pawing at the floor. In pasture management operations, sows about to farrow will build a nest or bed of grass and straw.



Delmar/Cengage Learning

FIGURE 15-2

Baby pigs should be kept warm and dry. To help avoid crushing, piglets should have a warm place provided that is away from the sow.

colostrum

first milk from the mother after birth, rich in antibodies and minerals

navel cord

the cord attaching the baby animal to the mother's placenta

Supplemental heat should be provided to newborn pigs (Figure 15-2). Experience and research have shown that supplemental heat can save one or more pigs per litter from death due to complications from chilling after birth. The first 24 hours after birth is a critical time for newborn animals, especially pigs. Supplemental heat is generally provided with heat lamps, but heating mats may also be used.

A sow may need assistance while giving birth. Complete farrowing of the litter is usually accomplished within five hours. Many producers breed groups of sows to farrow about the same time and are present in the farrowing house to assist the birthing process as needed. The extra pigs saved have a big influence on profits.

It is essential that piglets nurse shortly after birth to receive disease protection from the **colostrum** of the sow. Weak pigs should be dried off to prevent chilling and placed near the sow's udder to encourage nursing.

Processing and Care of Piglets

The processing of baby pigs or piglets involves the care provided to ensure they will survive and thrive. Processing includes clipping of the navel cord, clipping needle teeth, tail docking, iron injection, and castration of the males.

Navel cords should be clipped soon after birth. During gestation, the navel cord supplies nutrient-rich blood and oxygen to the developing piglet. When the pig is born, the navel cord can be an easy route for diseased organisms to enter the pig's body. As a precaution, the navel cord should be cut 1.0 to 1.5 inches (2.5–3.8 cm) from the body and the stub should be treated, usually with tincture of iodine, to prevent disease.

Needle teeth should be clipped soon after birth. Piglets are born with eight very sharp needle teeth located on the sides of the upper and lower jaws. Needle teeth can damage the sow's udder and wound other piglets (Figure 15-3).

FIGURE 15-3

The needle teeth of baby pigs are clipped to prevent injury to siblings and the mother.



Delmar/Cengage Learning

FIGURE 15-4

Piglets may be ear notched for identification.



Delmar/Cengage Learning

Piglets may be ear notched or ear tagged for identification. Identification is necessary for keeping accurate records. An identification system helps in selecting replacement animals, identifying problem litters, and determining rates of gain and feed efficiency. Purebred associations require ear notching for the registration of pigs. Many commercial swine producers do not ear notch their pigs, or may only ear notch certain litters for tracking purposes (Figure 15-4) and (Figure 15-5).

tail docking

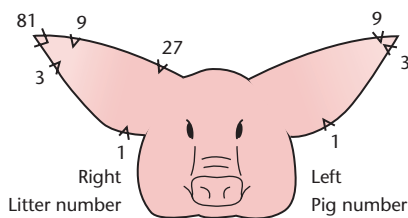
the practice of cutting off the pig's tail 1/4 to 1/2 inch (0.6-1.3 cm) from the body

anemia

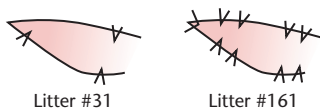
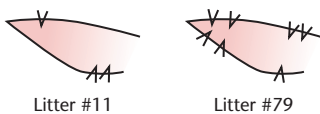
a deficiency of iron in the blood

Tail docking is usually performed within 1–3 days of birth (Figure 15-6). The tail stub should be treated with a disinfectant such as iodine spray to prevent infection. Docking tails discourages tail biting and helps reduce aggressive behavior in confinement. Tail biting causes open wounds and infections that reduce productivity and cause pain to the pig.

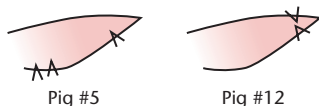
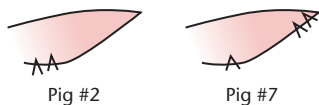
An iron injection should be given when the piglets are two to four days old to prevent **anemia**. Anemia causes slow weight gain and makes pigs more prone to disease and infections. Pigs raised on pasture can get enough iron from ingesting soil. Pigs raised in confinement without access to soil must get an iron shot (Figure 15-7).



Key to standard ear notching system



Examples of litter numbers



Examples of pig numbers

FIGURE 15-5

A standard ear notching system for pigs.

**FIGURE 15-6**

Tail docking prevents pigs from biting each other's tails.

**FIGURE 15-7**

Iron injections are given to baby pigs in the neck.

castrate

removal of male sex organs

boar taint

an objectionable flavor and odor in the pork of boars

Male pigs that are raised for harvest must be **castrated** to avoid **boar taint**. Boar taint refers to the objectionable flavor and odor of the pork from boars. Boar taint comes from the male hormone testosterone, found in the genitals of the male animal. Males should be castrated within the first few days after birth.



Social Studies Connection

Boars are not castrated in Europe due to the objections of animal welfare groups. Instead, boars are harvested at about 220 pounds (100 kg) before they reach sexual maturity so that the meat will not develop boar taint.

creep feed

a feed that is given to piglets as a supplement before weaning to reduce the stress of stopping their milk diet at weaning

Piglets are usually weaned at about 21 days of age. Piglets are sometimes given **creep feed** to reduce the stress associated with weaning and make the transition to solid feed easier.

Management from Weaning to Market

From weaning to market, the major management concerns of swine are feeding and facilities. During this process, pigs should be grouped in uniform size lots by weight. Pigs are often segregated by sex because males gain weight faster than gilts.

all-in/all-out

moving pigs as a group through each stage of production

Many swine producers employ the **all-in/all-out** method of finishing hogs. In this system, pigs are moved as a group through each stage of production to market. Groups consist of pigs about the same age and size. This produces a uniform market pig that is also desirable to the processor. In an all-in/all-out system, the facilities are cleaned and disinfected between groups of pigs to help reduce the transmission of disease.

Feeding Swine

Providing pigs with a well-balanced ration is one of the most important factors of production. Feed costs account for about 70 percent of the total cost of raising hogs. Feed efficiency should be in the range of 3 pounds of feed per pound of gain for hogs being finished for market. The nutrient needs of hogs include energy (from carbohydrates and fats), protein, minerals, vitamins, and water (Figure 15-8). These nutrients must be obtained from sources other than roughages since hogs are **monogastric** animals. Monogastric animals cannot digest nutrients from roughages such as grass and hay.

Ingredients used in hog rations are usually ground to increase feed efficiency (Figure 15-9). The ground feed may be fed as a meal or pellets. Pelleted feeds are more expensive than meal, but pellets have some advantages such as less waste and improved feed efficiency. Small producers sometimes buy nutritionally balanced commercial feeds. These feeds contain all the nutritional components necessary for healthy pigs. Larger operations mix their own swine feed on the farm or obtain feed in bulk from feed plants.

monogastric

a simple or one compartment
stomach



FIGURE 15-8

Pigs should have access to feed at all times on the finishing floor.

FIGURE 15-9

Ground feed rations are used in swine facilities to make the feed more digestible.



Courtesy of Scott Register



Science Connection

Other than primates, the organs and digestive system of the pig are more like those of humans than any other animal. Human and swine gastrointestinal tracts are so similar that hogs are used in nutrient trials for humans, and pig body parts, such as heart valves, are used for implantation in humans.

Energy Feeds

Corn is the most widely used energy feed for swine in all regions of the United States. It is palatable, high in digestible carbohydrates and fatty acids, and low in fiber. Corn contains about 8–9 percent protein but lacks some amino acids that are essential for swine nutrition. Corn alone does not meet all the nutritional needs of pigs. It must be supplemented with protein, minerals, and vitamins to ensure a balanced ration. Other energy feeds that may be used in swine rations include: barley, milo, wheat, oats, and rye.

Protein Supplements

Soybean meal is an excellent protein source and is the most widely used protein supplement in hog rations. It is available in 44–48 percent protein forms.

Other protein supplements used in swine feed include: cottonseed meal, linseed meal, and peanut meal. Hog rations can also contain animal meal as a protein source, such as blood meal or chicken meal.

Vitamins and Minerals

The four major minerals frequently added to hog rations are calcium, phosphorus, sodium, and chlorine. Some vitamins are already present in feed ingredients such as corn and soybeans. Vitamins and minerals are important for metabolic processes in the body.

Water

Water is the most important nutrient. All systems in the hog's body are dependent on water. Hogs should have plenty of fresh, clean water available at all times. A 200-pound pig can drink up to 2.5 gallons of water per day. A sow and her litter can drink up to 6 gallons per day (Figure 15-10).

Additives

Feed additives increase growth rate, improve feed efficiency, and reduce disease and stress. The additives sometimes used in hog rations are dewormers (anthelmintics) and antibiotics. With certain additives,



FIGURE 15-10

Automated waterers are most often used in swine facilities.

withdrawal time

the time an animal must be off medication before being harvested

such as antibiotics, federally regulated **withdrawal times** must be observed. Withdrawal time is the time required to elapse before harvest to make sure that an administered chemical has been eliminated from the body. Withdrawal times are strictly observed so that additives do not enter the food supply. The manufacturer's recommendations on feed additive use should be followed.

flushing

to increase the amount of feed for a short period before breeding to stimulate the ovulation rate for potentially bigger litters

Feeding the Breeding Herd

About ten days before breeding, sows should be given an increased amount of feed to stimulate the ovulation rate for potentially bigger litters. This process is called **flushing**. After being bred, sows and gilts should be given limited amounts of feed so they do not become too fat.

Sows and gilts should not be allowed to become fat during gestation. Excess fat applies pressure to the reproductive tract and may kill the developing pigs. Feed should be adjusted based on individual needs. Gilts are still growing during gestation and require feed, not only for piglet development but also for maintenance and growth of their bodies. Sows and gilts may be fed on pasture during gestation. However, most modern hog farms keep sows in confinement housing. Group pens are common for housing sows (Figure 15-11).



FIGURE 15-11

Group pens are sometimes used for sows during gestation.

Productive sows are heavy milkers, and require a high protein and fat diet while nursing pigs. A typical lactation ration will contain 18 percent protein and 5–10 percent fat. Sows must have the proper diet and enough feed to produce large quantities of milk for the piglets, and to rebuild their bodies after farrowing. If sows are in good body condition, they will come into heat faster after weaning, and conception rates for the next litter will be higher.

The feeding program for boars should control animal weight while providing adequate nutrition. Boars should be kept on limited rations so they do not become too fat. Fat boars are sluggish and make poor breeders.



Science Connection

A sow grunts a variety of different sounds while feeding her piglets. Because her milk supply lasts only 15–20 seconds per feeding, she must cue her piglets to pay attention and suckle when it is feeding time. The sow communicates with her piglets by grunting.

Feeding Growing-Finishing Pigs

Weaned pigs may go to a nursery or directly to the finishing barn. Young pigs need more protein in their diet than older pigs. The relationship between weight and the percent of crude protein in the diet is shown in Table 15-1.

TABLE 15-1

Relationship between Weight and Crude Protein

Weight	Percent crude protein in diet
40–65 pounds (18–29 kg)	18–19%
65–95 pounds (29–43 kg)	16–17%
95–140 pounds (43–63 kg)	15–16%
140–195 pounds (63–88 kg)	14–15%
195–+ pounds (88–+ kg)	12–13%

Barrows and gilts have different nutritional needs. For example, gilts need more protein than barrows. Barrows gain about 8 percent faster than gilts. However, gilts generally produce carcasses with less backfat and a larger loin-eye area.

Producers sometimes segregate finishing hogs by sex. Feeding gilts and barrows in separate groups improves feed efficiency and overall performance. With this feeding system, producers can more closely match the diet specifications of males and females. **Split-sex feeding** requires more facilities, such as separate barns and feed-handling systems. Split-sex feeding is most economical in large swine operations.

split-sex feeding

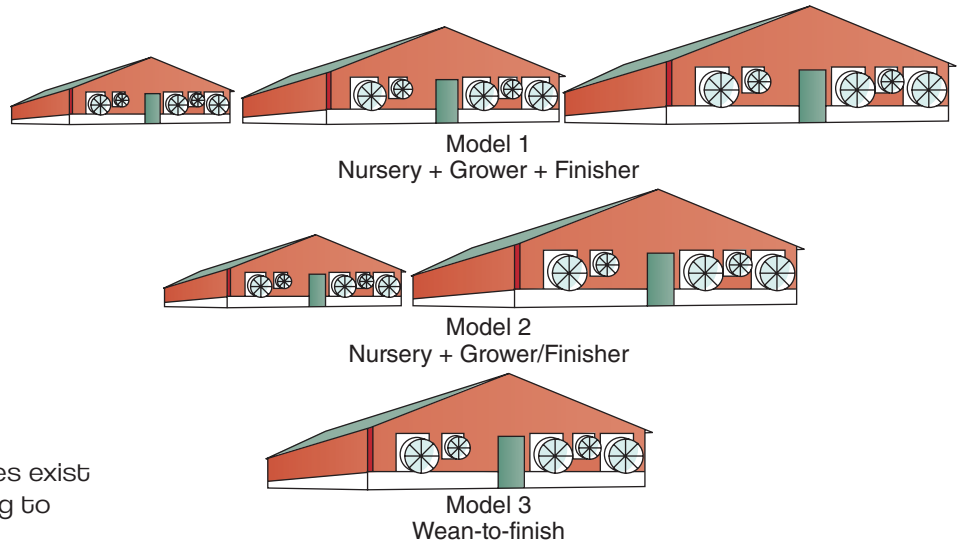
the system of feeding males and females separately

Swine Housing and Equipment

Most modern swine producers use confinement systems specifically designed for swine production. These are generally large operations with a high degree of automation to reduce labor costs. While modern confinement systems require a high investment in facilities and equipment, the reduction in other costs, such as labor, generally makes pork production possible at a lower cost.

Kinds of Buildings

Several building systems are used in the swine industry. The type of building is based on the stages of production. Three types of facilities for growing pigs from weaning to finishing are shown in Figure 15-12. The trend in swine operations is to use one barn for breeding, gestation, and farrowing, and another barn for wean-to-finish. In these operations, weaned pigs are taken from the farrowing house at about 21 days of age and placed in the wean-to-finish barn, where they will remain until they reach market weight.

**FIGURE 15-12**

Three basic models of facilities exist for growing pigs from weaning to finishing.

Delmar/Cengage Learning

FIGURE 15-13

Lagoons are used in commercial swine operations for waste management.



Delmar/Cengage Learning

Manure Management

A major problem for swine producers is pollution of the environment by excessive amounts of nitrogen, phosphorus, and ammonia in the manure. Large production operations with large numbers of animals in a small, confined space make manure management a problem, both with manure disposal and odor control. Manure can be stored in a number of ways prior to being spread onto fields as fertilizer. **Lagoons** are often used to store manure and to promote decomposition (Figure 15-13).

lagoon

a large holding pond used to store manure and promote decomposition

Ventilation

Many hog barns are fully enclosed and must be ventilated. Hogs are healthier when they have fresh air. Hog houses are ventilated in order to control air temperature, remove excess moisture, and control odors. The amount of ventilation required varies with the season. Ventilation is needed in winter months for moisture and odor control. More ventilation will be needed during summer months for temperature control. In hot weather, sprinkler systems are often used to help cool hogs.

Floors

Floors of swine barns are generally solid or slotted. Solid concrete floors are cheaper, but manure removal is more difficult. Slotted floors almost eliminate manure handling because manure falls through the slots in the flooring. The manure is stored underneath. Swine flooring is usually made of concrete, metal, fiberglass, or plastic.

gestation crates

a device that houses a sow from breeding till farrowing

Gestation Facilities

Gestation crates have been used since the 1990s to house gestating sows. In this system, sows stay in the gestation crates twenty-four hours a day from breeding until they are moved a few days before farrowing to farrowing crates. Gestation crates (Figure 15-14)



FIGURE 15-14

A combination of loose housing and gestation stalls allow sows to come and go freely.

Courtesy of Chore-Time Systems, Milford, Indiana

have been a controversial issue between animal rights activists and producers. Some states have banned gestation crates and most producers in other states are moving to group housing for gestating sows. Grouping sows together causes some problems, including injury to other animals from dominant sows. Group housing takes more labor as well. Workers must put sows temporarily into individual stalls for feeding, breeding, pregnancy scanning, and treatment purposes.

Farrowing Crates

Farrowing crates protect the baby pigs by limiting movement of the sow. Guardrails in the farrowing crates help prevent the sow from laying on the piglets and crushing them. A heat lamp or heating mat warms the piglets and attracts them to the sides of the farrowing crate. Farrowing crates are generally constructed of metal for durability. Crates may also be constructed of wood (Figure 15-15).



FIGURE 15-15

Farrowing crates should allow the sow to lie down and provide an area for the pigs where they are safe from being crushed by the sow.

Diseases and Parasites

A good herd health program is essential to profitable swine production. Diseases and parasites are a major problem for swine producers. Swine producers try to prevent disease and parasite problems because prevention is less expensive than treating the problem.

In recent years, changes in production practices have made herd health problems more difficult to manage. More hogs are being raised in confinement in large numbers and sometimes crowded conditions. In addition, hogs are being fed rations designed to push them to maximum growth rates. These management trends put more stress on pigs, and that often leads to increased health problems.

Health records should be maintained on a continuing basis. Records of health, reproduction, feed intake, and feed conversion should be updated regularly. Proper records may help with early detection of health problems.

Good management practices such as sanitation, isolation of new animals, and biosecurity are all part of good herd health maintenance. Good biosecurity includes restricting entry of visitors, as well as dogs, cats, birds, and other animals. Any of these can carry diseases into the swine facility.

Infectious Diseases

Numerous infectious diseases affect swine. Most are caused by bacteria or viruses. Only a few of the most common and serious diseases are discussed here.

Swine Dysentery Swine dysentery, also known as bloody scours or black scours, is caused by a bacterium. Dysentery most commonly affects pigs from 8 to 14 weeks of age. Symptoms include bloody diarrhea, weight loss, fever, and refusal to eat. Dysentery may be confused with other pig scouring (diarrhea) problems.

zoonotic disease

a disease that can be passed from animal to human, or from human to animal

Erysipelas Erysipelas is caused by a bacterium. It mostly affects pigs from weaning to market age. Symptoms of erysipelas include fever, withdrawal from the herd, lameness, depression, signs of chilling, and sudden death. Reddish colored, diamond-shaped lesions often appear on the skin.

Influenza Influenza or swine flu is a common respiratory disease caused by a virus. Diseased pigs have symptoms including fever, lack of appetite, coughing, difficulty breathing, and weakness. Pigs usually recover in about six days, but they may remain unthrifty for several days afterwards. The flu is a common **zoonotic disease**.

Leptospirosis Leptospirosis is a disease caused by bacteria. The most common symptom of leptospirosis is abortion. Other symptoms that may appear include fever, diarrhea, and loss of appetite.

Swine Pneumonia Swine pneumonia is caused by a bacterium. It is one of the most economically damaging swine respiratory diseases. Death losses are low, but feed intake and growth are reduced. Almost all swine farms in the United States are thought to be infected.

Porcine Circovirus Porcine circovirus is caused by a virus. Circovirus has resulted in great economic loss in the swine industry. Symptoms include a progressive loss of body condition, pale skin, difficulty breathing, enlarged lymph nodes, and diarrhea.

Porcine Reproductive and Respiratory Syndrome (PRRS) Porcine Reproductive and Respiratory Syndrome (PRRS, pronounced ‘purrs’) is one of the most economically devastating swine diseases. PRRS is caused by a virus. The symptoms of PRRS include abortion, weak pigs, and severe respiratory disease in young pigs. Vaccination for PRRS and good management practices help reduce incidences of the disease.

Transmissible Gastroenteritis (TGE) Transmissible gastroenteritis is one of the most serious diarrhea-causing diseases. This viral disease is most severe in baby pigs under ten days old. Almost all

infected baby pigs die. TGE spreads rapidly, especially in farrowing houses. Symptoms in young pigs include vomiting and diarrhea. TGE is highly contagious.

Scours Scours, or diarrhea, is a contagious disease that is most serious in baby pigs. Scours is caused by several different bacteria. The disease has a high death rate in baby pigs because their small bodies become dehydrated quickly. Good sanitation can help prevent scours.

Nutritional Health Problems

Anemia is the most common nutritional health problem. It is caused by a lack of iron. Symptoms appear in piglets from 1 to 2 weeks of age. Signs of anemia are poor growth, roughened hair coat, and difficulty breathing. Anemia lowers the pig's resistance to other diseases. To prevent anemia, pigs are given an iron injection shortly after birth.

Poisoning is sometimes seen in swine, usually from moldy feed. Feed may also be contaminated with a number of materials that are poisonous to hogs, including pesticides and other chemicals used around feeds and in the feed mixing area.

External Parasites

External parasites are generally easy to control in confinement operations with preventative care. They cause economic loss, but not as much as internal parasites and swine diseases. External parasites are a bigger problem for swine raised outdoors.

Hog Lice The hog louse is a gray-brown bloodsucking pest. Lice tend to cluster in the ears, on the insides of the legs, and around the folds of skin on the neck of hogs. They cause extreme irritation to the hogs and poor weight gain.

mange

an inflammation of the skin caused by a microscopic mite

Mange Swine **mange** is an inflammation of the skin caused by a microscopic mite. Mange mites bore into the skin and feed on blood, causing severe itching. Hogs rub at the affected areas until their



Delmar/Cengage Learning

FIGURE 15-16

Roundworms are a common intestinal parasite of swine.

porcine stress syndrome (PSS)

a genetic disorder in pigs that can result in sudden death

genetic disorder

a health problem, caused by a defect in the genes, that can be passed from parent to offspring

skin becomes inflamed and scabby. Mange-infested animals fail to gain properly, are poor feed converters, and are more susceptible to diseases.

Internal Parasites

The four groups of internal parasites of hogs are roundworms, tapeworms, flukes, and protozoa. Roundworms cause more damage to hogs than any other internal parasite. Of the several species of roundworms that attack swine, the most serious is the large intestinal roundworm (ascaris) (Figure 15-16).

Internal parasites in hogs cause slow growth and make pigs more susceptible to other health problems. Symptoms include rough hair coat, weakness, unthrifty appearance, and diarrhea. Producers can control parasites by employing sanitary practices and treating infestations with dewormers (anthelmintics). If hogs are on pasture, the pasture should be divided and hogs rotated frequently between pastures to break the life cycle of internal parasites.

Porcine Stress Syndrome (PSS)

Porcine stress syndrome (PSS) may cause heat stress, muscle tremors, breathing problems and sudden death (Figure 15-17). PSS is caused by a **genetic disorder** carried on a recessive gene. A genetic disorder is a health problem caused by a defect in the genes.

PSS can be prevented by selecting breeding animals that do not carry the recessive gene. The gene has been eliminated from most commercial lines of breeding stock. Signs of PSS are constant movement, tail twitching, and trembling ears. Red and purple splotches may develop on the skin when the hog is excited. Pigs that have PSS must be managed with care. Moving and handling must be done in a way to minimize stress. Pigs with PSS are more likely to show symptoms during hot weather. They can be blood-tested to determine if they are susceptible to PSS.



Delmar/Cengage Learning

FIGURE 15-17

Pigs with the PSS gene are subject to porcine stress syndrome, especially in hot weather and when stressed.



Science Connection

PSS is caused by a recessive gene. A recessive gene is a gene that is carried, but not expressed. Blue eyes in humans are also caused by a recessive gene. Research has shown that all blue-eyed individuals originated from a single common ancestor. Originally, everyone had brown eyes. A genetic mutation in one person occurred over 6,000 years ago, causing that person to have blue eyes. That person passed the recessive gene for blue eyes to all of his or her ancestors. Eventually, a male and female descendent of the first blue-eyed person, carrying the recessive gene, married and blue-eyed children were born. All blue-eyed humans on earth are linked to the first person that had blue eyes.

Marketing

Marketing decisions have a direct effect on profitability. Producers must carefully study available marketing options. If a producer is raising hogs under contract, the price may be determined at the beginning of the production period. Consumer demand for less fat and cholesterol in red meat has pressured the swine industry to produce leaner hogs. Producers who raise the kind of high-quality hogs that are in demand generally receive higher prices.



History Connection

During the War of 1812, a New York pork packer named Uncle Sam Wilson shipped a boatload of several hundred barrels of pork to U.S. troops. On the docks, each barrel was stamped with “U.S.” on the front. One day when Sam Wilson was asked what “U.S.” stood for, he jokingly replied that it stood for “Uncle Sam.” This is how “Uncle Sam” came to represent the U.S. Government.

Kinds of Markets

Hogs may be sold in a number of ways, including direct marketing and auction markets. Most hogs are direct-marketed to packing plants, order buyers, or buying stations. Most of the direct-marketed hogs are grown under contract with the packer.

Market Classes and Grades

The use, sex, and grade of swine determine their market classification. The five sex classes of swine for harvest are barrows, gilts, sows, boars, and stags. Most hogs are harvested as barrows and gilts at about 260 to 280 pounds. In general, it takes about 6 months to produce a pig from birth to market weight.

The grade standards established by the USDA for barrows and gilts are based on carcass quality, and the yield of the four lean cuts. The four lean cuts are: ham, loin, picnic shoulder, and Boston shoulder (Figure 15-18).

The five official USDA grades for barrows and gilts are: U.S. No. 1, U.S. No. 2, U.S. No. 3, U.S. No. 4, and U.S. Utility (Figure 15-19). The two major factors

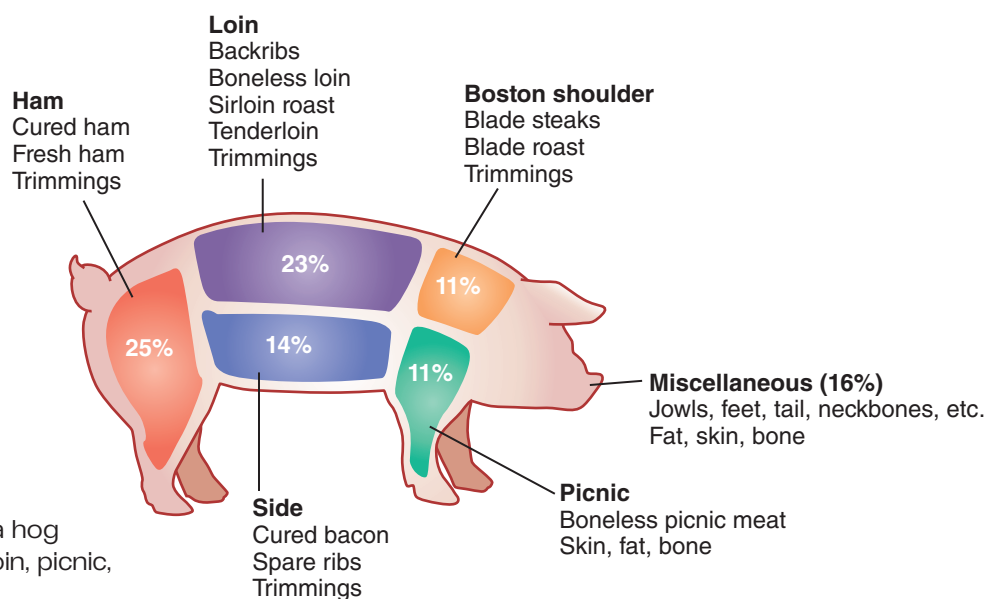
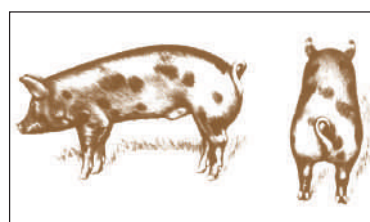


FIGURE 15-18

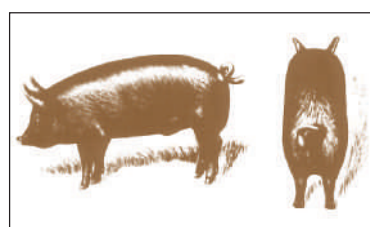
The four lean cuts out of a hog carcass include the ham, loin, picnic, and Boston butt.



U.S. No. 1



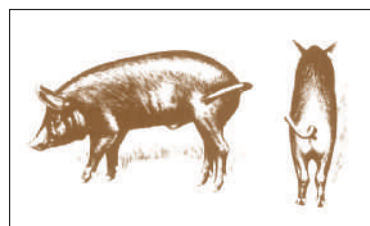
U.S. No. 2



U.S. No. 3



U.S. No. 4



U.S. Utility

Courtesy of USDA

FIGURE 15-19

USDA grades for market barrows and gilts.

Pork Quality Assurance Plus Program (PQA Plus)

an educational program for swine producers that emphasizes swine herd health and animal well-being

used to determine these grades are the estimated backfat thickness over the last rib and the muscling score. Grades 1 through 4 all produce carcasses with acceptable lean meat quality and acceptable belly thickness. The difference is in the percentage, of lean cuts in the hog (ham, loin, picnic shoulder, Boston shoulder). The U.S. No. 1 has the highest percentage of lean cuts at over 60 percent. As the grade number increases, the percentage of lean cuts decreases. The U.S. Utility grade has a thin covering of fat, produces an unacceptable percentage of lean cuts, and has unacceptable belly thickness. This grade is not available in supermarkets for consumers to purchase.

Pork Promotion

The National Pork Board, established in 1985, is funded by assessing a fee on all pork sold in the United States. The Pork Board promotes the use of pork, develops foreign markets, provides consumer information, conducts research, and produces educational programs.

Major advertising campaigns of the Pork Board promote pork as a safe, healthy, and nutritious food. “Pork: The other white meat,” a slogan created by the National Pork Producers Council and promoted by the National Pork Board, has been one of the most successful taglines in advertising history. The use of the tagline has helped pork remain competitive with other meat sources.

Pork Quality Assurance Plus Program (PQA Plus)

The National Pork Board’s **Pork Quality Assurance Plus Program (PQA Plus)** is an educational program for swine producers that emphasizes swine herd health and animal well-being. The program is based on ten good production practices:

1. Establish and implement an efficient and effective herd health management plan.

did you know?

The number one sandwich served in American homes is the ham sandwich.

2. Use an appropriate veterinarian/client/patient relationship as the basis for medication decision-making.
3. Use antibiotics responsibly.
4. Identify and track all treated animals.
5. Maintain medication and treatment records.
6. Properly store, label, and account for all drug products and medicated feeds.
7. Educate all animal caretakers on proper administration techniques, needle-use procedures, observance of withdrawal times, and methods to avoid marketing adulterated products for human food.
8. Follow appropriate on-farm feed and commercial feed processor procedures.
9. Develop, implement, and document an animal caretaker training program.
10. Provide proper swine care to improve swine well-being.

Participation in the PQA Plus Program is optional. Some livestock shows require exhibitors to be PQA Plus-Certified, and some processors will only purchase hogs or contract for the production of hogs with PQA Plus-Certified Producers.

Summary

Phases of hog production include breeding, gestation, farrowing, and finishing. Specific management practices must be followed at each of these stages to ensure the health of the herd and the profitability of the enterprise.

The most important objective of breeding and farrowing management is to produce large litters of healthy pigs. Crossbreeding is important to obtain the benefit of heterosis. AI (artificial insemination) is commonly used in large operations but natural mating is still popular, especially with smaller operations. Pigs are protected from being crushed by the sow in farrowing stalls. Processing piglets in the first few days of life includes

clipping needle teeth, castration of the males, tail docking, and an injection of iron. Ear notching may be used for identification. In the finishing process, a wean-to-finish, one barn system is becoming most popular.

The nutrient needs of hogs include energy, protein, minerals, vitamins, and water. Different feed formulations are used, depending on the stage of production. The most widely used feed is corn, with soybean meal added as a protein supplement. If antibiotics, anthelmintics, or other additives are included in the feed, withdrawal times must be observed. Breeding animals must not be allowed to become too fat. Finishing swine have different nutritional requirements based on weight and sex.

Almost all commercially produced pork is produced in confinement buildings. The trend is to utilize two barns: one for breeding, gestation, and farrowing, and another for finishing. Gestation crates, once widely used in the swine industry, are being replaced with group housing for sows. Manure management is one of the major concerns of swine producers. Swine barns must be maintained for air movement, air quality, and temperature control. Swine barns can have floors that are solid concrete or slatted floors which can be made out of concrete, metal, fiberglass, or plastic.

Disorders of swine include internal and external parasites, diseases, nutritional ailments, and genetic disorders. Diseases can spread quickly through confinement buildings. Roundworms are the most damaging internal parasites of swine. Anemia of piglets is the most common nutritional disease, but can be prevented with an iron injection. PSS (Porcine Stress Syndrome) is a serious genetic disorder of swine. PSS has been almost eliminated from commercial lines of swine. Producers must maintain a comprehensive health plan for their herds, and take appropriate measures to prevent the incidence of diseases and parasites.

Hogs are marketed in many ways. Contracting for hog production is increasing in popularity. The USDA has established grades for market swine, U.S. No. 1 – 4 and U.S. Utility. U.S. No. 1 is the most desirable and U.S. Utility is the least desirable.

The Pork Board was established to promote pork, develop markets, provide consumer information, and conduct research. The Pork Board administers the Pork Quality Assurance Plus Program (PQA Plus) for producers. PQA Plus focuses on swine herd health and animal well-being.

Quick Facts

- The estrous cycle in the pig averages 21 days.
- The gestation period of swine is 113 days or three months, three weeks, and three days.
- Pigs are usually weaned at around 21 days of age.
- Corn is the basis of most swine diets, and soybean meal is the most commonly used protein supplement.
- Feeding gilts and barrows in separate groups (split sex feeding) improves overall performance.
- Most hogs are raised in confinement buildings.
- Swine production phases include breeding, gestation, farrowing, and finishing.
- The industry average of pigs weaned per litter is about 9.5.
- Crossbreeding market hogs is a recommended practice to achieve hybrid vigor or heterosis.
- It is essential that piglets nurse shortly after birth to receive disease protection from the colostrum in their mother's milk.
- Processing baby pigs includes clipping the navel cord, clipping needle teeth, tail docking, iron injection, and castration of the males.
- Male pigs that are raised for harvest must be castrated to avoid boar taint.
- The all-in/all-out method of finishing hogs helps prevent disease.
- Pigs are monogastric animals, and other than primates, their digestive system and organs are more like those of humans than any other animal.
- Feed is ground or pelletized in most swine operations.
- Water is the most important nutrient.
- Federally regulated withdrawal times must be observed for certain feed additives.
- Flushing sows (increasing the amount of feed for a short period of time) before breeding helps to stimulate the ovulation rate for bigger litters.
- Sows, boars, and gilts must be limited on feed so they do not become too fat.
- Productive sows are heavy milkers, requiring more feed and a high protein and fat diet while nursing pigs.
- Younger pigs need more protein in their diet than older pigs.
- A major problem for swine producers is manure management and disposal.

- Gestation crates are losing favor and are being replaced by group housing of sows.
- Farrowing crates are equipped with guardrails to protect the baby pigs.
- Roundworms are the most damaging internal parasites of swine.
- Porcine stress syndrome (PSS) is a serious condition that is caused by a genetic abnormality.
- Most hogs are marketed directly to packing plants, order buyers, or buying stations.
- The four lean cuts of pork are: ham, loin, picnic shoulder, and Boston shoulder.
- The five official USDA grades for market barrows and gilts are: U.S. No. 1, No. 2, No. 3, No. 4, and U.S. Utility.
- The PQA Plus Program is an educational program that emphasizes animal health and well-being.

Student Learning Activities

1. Ask a swine producer to discuss management methods with the class.
2. View a video on artificial insemination or have a producer demonstrate artificial insemination.
3. View a video on swine production or visit a swine production facility.
4. Prepare and present a report on the PQA Plus Program.
5. Visit a hog farm when sows are farrowing.

Discussion Questions

1. What is the PQA Plus Program? How does it help the pork industry?
2. Explain the major management components of swine production.
3. Explain housing options for swine.
4. What are some of the diseases that affect hogs?
5. At what weight are most hogs harvested? Why?

Review Questions

True/False

1. The gestation period for a sow is 250 days.
2. Farrowing crates help prevent the sow from crushing the piglets.
3. Colostrum is the first milk given by the sow.
4. Feed costs account for about 90 percent of the total cost of raising hogs.
5. Fat sows and boars make good breeders.

Multiple Choice

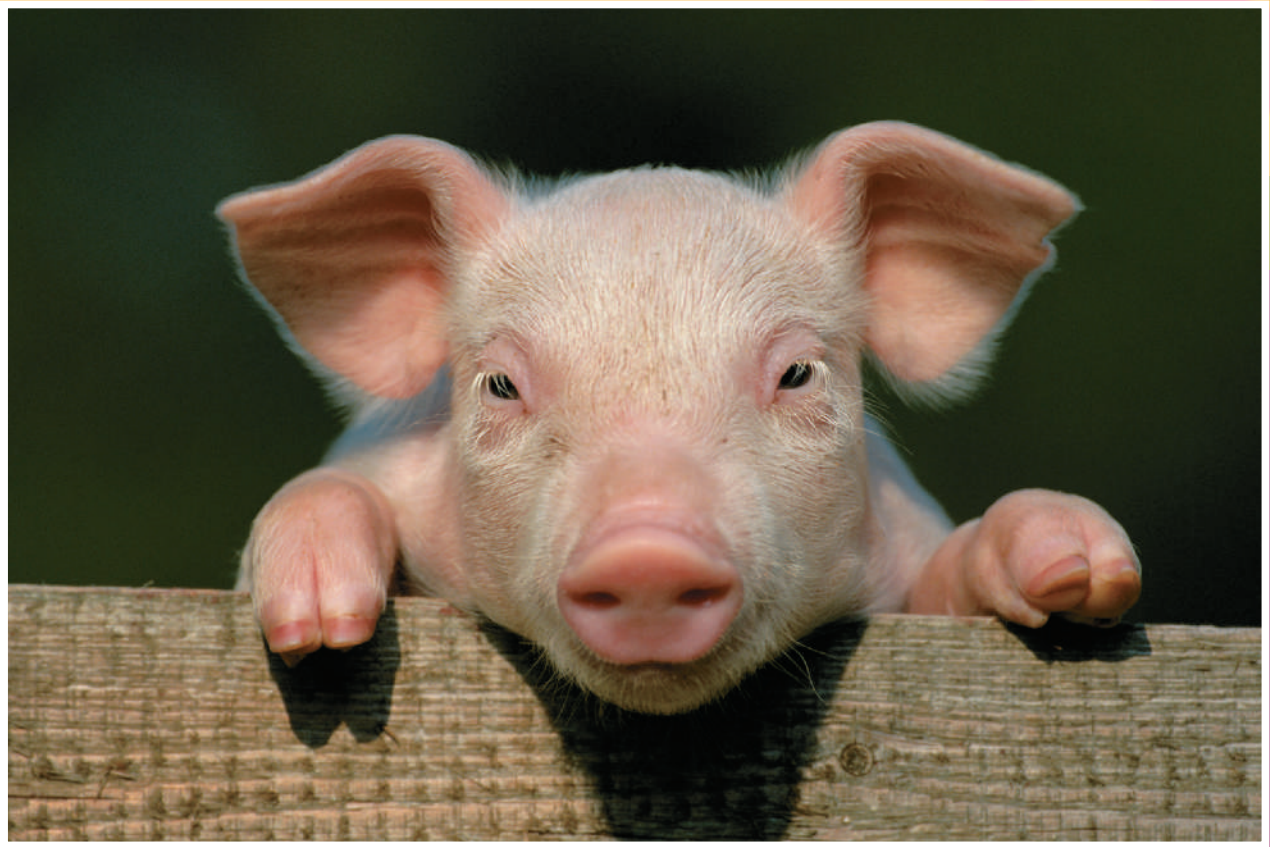
1. An iron injection should be given to baby pigs to prevent _____.
 - a. anemia
 - b. leptospirosis
 - c. mange
 - d. pneumonia
2. The most widely used energy feed in hog rations is _____.
 - a. corn
 - b. rye
 - c. wheat
 - d. alfalfa
3. Processing of piglets may include:
 - a. clipping needle teeth and navel cords
 - b. tail docking and castration
 - c. iron injection and ear notching
 - d. all of the above
4. Piglets are usually weaned at about _____ days of age.
 - a. 50
 - b. 41
 - c. 35
 - d. 21
5. Feed efficiency should be in the range of _____ pounds of feed per pound of weight gained.
 - a. 10
 - b. 5
 - c. 2
 - d. 3

Completion

1. _____ is the ratio of pounds of feed consumed per pound of weight gained.
2. Baby pigs are often given _____ feed to make weaning and transition to solid food easier.
3. Another name for scours is _____.
4. The grade standards established by the USDA for barrows and gilts are based on _____ quality and the yield of the four lean cuts.
5. _____ is the improvement of offspring over the parents that results from crossbreeding.

Short Answer

1. What are the four groups of internal parasites that affect hogs?
2. What is the gestation period for swine?
3. Explain the all-in/all-out method of raising hogs.
4. What are the four lean pork cuts?
5. What are the advantages of artificial insemination?



CHAPTER 16

Selecting and Judging Swine



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Explain the importance of selecting superior breeding stock.
- Select breeding stock using accepted criteria.
- Describe the different criteria for swine selection.
- Rank classes of market and breeding swine from most to least desirable.



KEY TERMS

backfat

lean

Symbol III

expected progeny
difference (EPD)

underline

type

finish

LANGUAGE CONNECTION

English	French	German	Latin	Spanish
Bacon	Lard	Speck	Laridum	El Tocino
Ham	Jambon	Schinken	Perna	El Jamón
Loin	Longe	Lende	Lumbus	El Lomo
Pork Chop	Côtelette de porc	Schweinekotelett	N/A	La Chuleta de Cerdo

backfat

standard measurement of body fat in swine

lean

muscle tissue of the body; meat lacking in fat

Selection of Breeding Stock

Modern consumers want more lean meat and less fat in their pork. **Backfat** is the standard measurement of body fat in swine. In general, the thicker the backfat, the lower the amount of lean meat, and the lower the backfat, the higher the amount of lean meat. Lean meat or **lean** is the muscle tissue of the body. One of the major factors in the price received for market hogs is lean value. That is, prices increase and decrease based on the lean-to-fat ratio. However, pigs should not be too lean. If pork is too lean, it affects the tenderness and flavor of the meat. Modern producers use genetics in their breeding programs to help assure that lean pork is mixed with the desired amount of fat. Figure 16-1 shows a pig with a desirable ratio of lean to fat. Purebred breeders select pigs with the genetic makeup to efficiently produce lean pork. New technology allows the use of ultrasound to measure the fat-to-lean content of live hogs and carcasses. This helps producers choose animals to keep for breeding stock and identify carcasses that are worth top dollar.

Most commercial producers buy breeding animals from seedstock companies. Seedstock companies market their own lines of crossbred hogs developed with specific genetic goals in mind. Purebred swine formed the foundation of the genetic lines used by commercial swine genetic



FIGURE 16-1

Pigs should be selected that have a desirable lean-to-fat ratio.

companies. However, most purebred swine are used in the show pig business instead of commercial pork production.

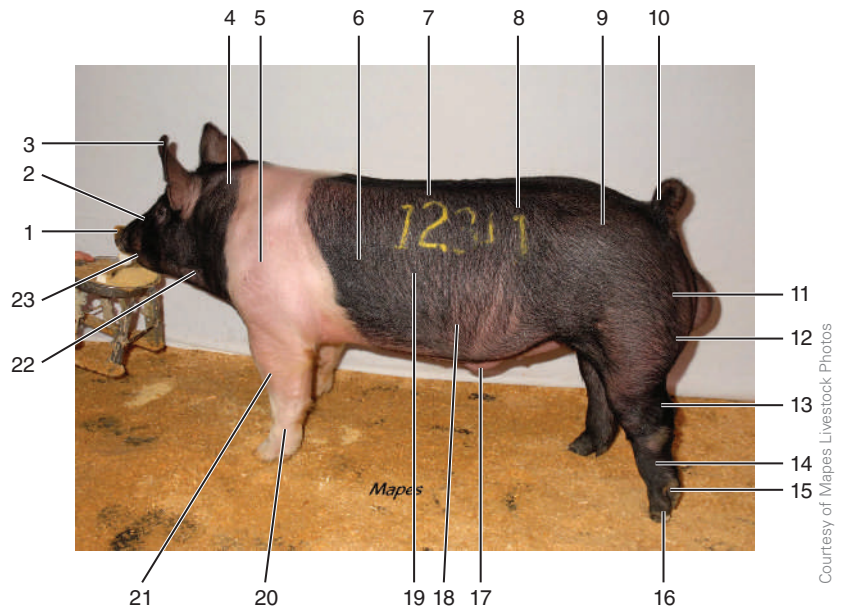
Practically all market hogs today are produced by crossbreeding programs such as rotational and terminal crossbreeding systems. Crossbred pigs tend to produce leaner pork. Good-quality, lean, heavily-muscled hogs sell for the highest prices. The goal of crossbreeding is to achieve hybrid vigor in the offspring. Hybrid vigor or heterosis is the superior characteristics obtained when crossbreeding purebred animals.

Parts of the Hog

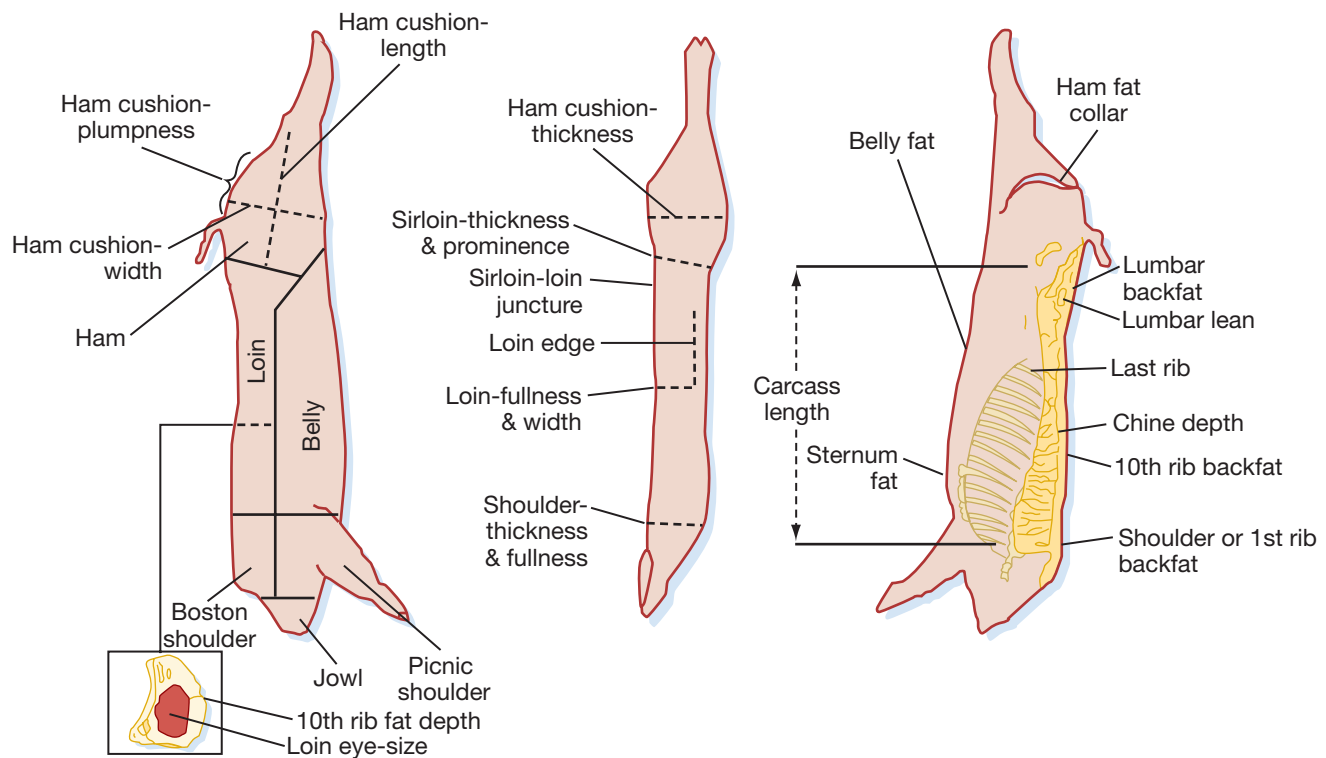
In order to properly select and judge hogs, one must know both the parts of a live hog and carcass parts or cuts of pork. A diagram of the parts of the live hog is shown in Figure 16-2.

The four primal (basic) cuts of the hog carcass are the ham, loin, Boston shoulder, and picnic shoulder. These four cuts represent the most valuable parts of the hog carcass. In a typical 280-pound (127-kg) market hog, the cuts will make up about 44 percent of the live weight and represent about 75 percent of the total value of the animal. Figure 16-3 shows the parts of a pork carcass.

- | | |
|--------------------|-------------|
| 1. Snout | 13. Hock |
| 2. Face | 14. Cannon |
| 3. Ear | 15. Dewclaw |
| 4. Neck | 16. Toe |
| 5. Shoulder | 17. Sheath |
| 6. Ribs | 18. Belly |
| 7. Back | 19. Side |
| 8. Loin | 20. Pastern |
| 9. Rump | 21. Knee |
| 10. Tail | 22. Jowl |
| 11. Ham | 23. Mouth |
| 12. Cushion of Ham | |

**FIGURE 16-2**

The parts of a pig.

**FIGURE 16-3**

Pork carcass parts and terminology.

Market Hog Description

Progress in identifying and selecting desirable breeding stock with better genetics has resulted in significant improvement in the quality of pork produced. Modern market hogs are leaner and more muscular when compared to hogs produced in the past.



Health Connection

THE COOK'S BEST FRIEND

Before about 1950, fat hogs were highly prized. Hog fat was rendered into lard, which has a number of qualities that made it ideal for frying and cooking all manner of foods. Due to its high saturated fat content, lard has fallen out of favor for health reasons, being replaced with vegetable oils, peanut oil, canola oil, olive oil, etc.

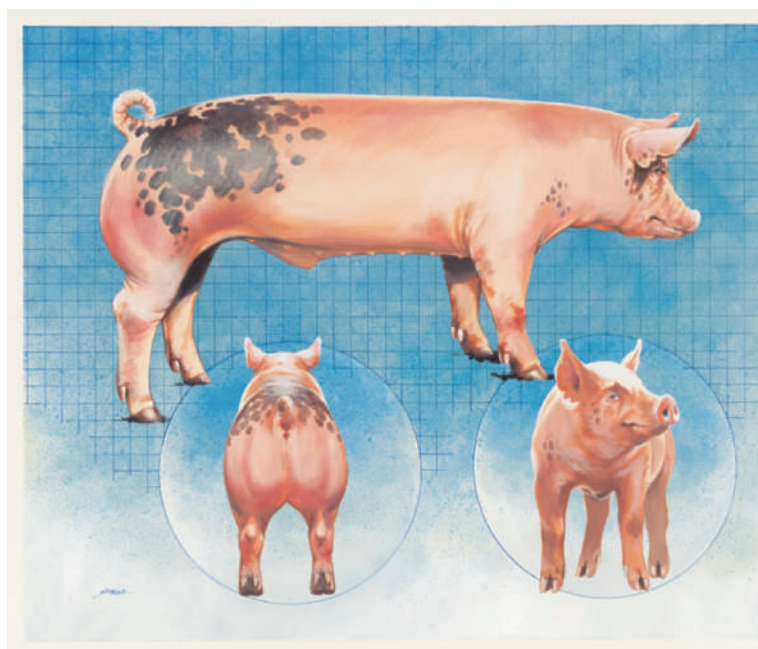
Symbol III

the NPPC designation for the ideal market hog

The National Pork Producers Council (NPPC) describes the ideal market hog as **Symbol III** (Figure 16-4). The ideal market hog has correctness of structure, production, performance, function, livability, attitude, health, and optimum lean yield. Symbol III also produces the best quality and safest pork that provides the optimum nutrients for human nutrition. Symbol III represents the model pig that swine farmers strive to produce.

FIGURE 16-4

Symbol III is an ideal market hog. This ideal market hog has correctness of structure, production, performance, function, livability, attitude, health, and optimum lean yield.



Courtesy of the National Pork Board

Genetic Evaluation of Breeding Stock

When breeding hogs, producers use performance records to select animals with superior traits for herd improvement. Much progress has been made during the past 20 years in the areas of feed efficiency, growth rate, reproductive efficiency, and carcass quality. Both performance testing and selecting superior breeding stock based on sound genetic principles has resulted in improved swine performance.

expected progeny difference (EPD)

an estimate of the genetic value of an animal in passing its traits to the offspring

Another evaluation tool commonly used by swine producers is **expected progeny difference (EPD)**. EPDs are an estimate of the genetic value of a boar or sow in passing its traits to the offspring. EPDs are numbers that represent expected performance of the offspring. These numbers can be negative or positive. For example, a sow may have a +2.0 listed for NW (number weaned); this means that the sow is expected to produce 2 more piglets than the average sow.

Buying top quality breeding stock is expensive, but can significantly improve feed and reproductive efficiency. Better genetics can also improve carcass quality, producing the kind of market hogs in demand by packers. Overall, the benefits of using genetically improved breeding stock outweigh the costs. Continued dedication to genetic improvement is necessary to keep pork competitive with other sources of meat in the marketplace. Artificial insemination in swine is becoming more popular and practical, providing producers with access to superior genetics.

Other Considerations in Selecting Breeding Animals

Both purebred swine breeders and breeding stock companies produce seedstock for crossbreeding purposes. Breeding stock producers should provide performance data to help assure genetic value. Other considerations include soundness of the individual animal, and overall health of the seedstock herd.



Medical Connection

CHINESE GLOWING PIGS

Genetic improvement not only benefits the swine industry, but also has the potential to save human lives. In 2006, researchers in China injected pig embryos with a fluorescent green protein, enabling the piglets to glow green under ultraviolet light (Figure 16-5). One of those pigs later gave birth to a litter of eleven piglets, two of which inherited the “glowing gene,” proving that the gene had effectively spread to all of the cells of the mother. Scientists hope that these experiments will lead to the production of pigs with organs that can be transplanted into humans without triggering rejection by the human body. The “glowing gene” will allow doctors to track genetically modified cells if transplanted into humans. This technology will help to follow blood flow through the body or through the transplanted organs, which may help solve some problems associated with transplanted organs that are rejected after surgery.



Deimar/Cengage Learning

FIGURE 16-5

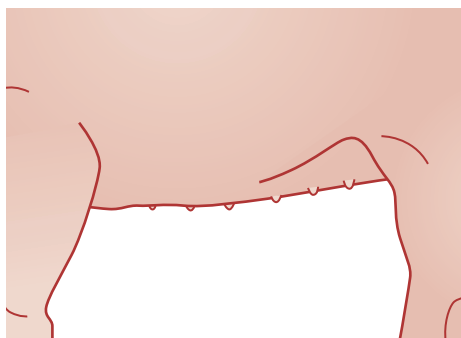
A sow in China was injected with a fluorescent green protein that was attached to a piece of DNA. All cells of the sow accepted the new DNA, and it was also incorporated into her egg cells during the process of meiosis. Her pigs glowed under ultraviolet light, indicating that this genetic modification had been passed to the offspring.

Soundness of the Animal Boars should have visibly sound reproductive organs. They should have well-developed testicles of equal size and show soundness in the feet and legs. Boars should be aggressive enough to mate, but not so aggressive that they are dangerous.

Producers should select females—gilts and sows—that have sound reproductive systems. Sows that have frequent problems during breeding,

underline

the underside of the belly that includes the mammary glands



Delmar/Cengage Learning

FIGURE 16-6

Breeding stock should possess a sound underline.

gestation, or farrowing should be culled from the herd. All females for the breeding herd should also show soundness of the feet and legs.

Both boars and gilts should have sound **underlines**, with seven or more functional nipples on each side (Figure 16-6). Functional nipples on females should be properly spaced and should be of sufficient size for ease of nursing. The underline is the bottom most portion of the belly and includes the mammary glands. The mammary glands produce milk for the piglets.

Health of the Seedstock Herd Breeding animals should be purchased from reputable breeders with healthy herds. The animals should be structurally correct and have no visible lameness. Purchased breeding animals should be vaccinated and dewormed. Information about the health of the herd and individual animals should be available from the breeder.

Judging Swine

Swine judging events are popular with FFA and 4-H members. Swine classes consist of four animals to be ranked from most desirable to least desirable (Figure 16-7). To judge a class of hogs, observe them from a distance of about 15 feet as they move around. Hogs will usually have an ear tag or number marked on their bodies for easy identification. Compare each hog with the ideal hog and the others in the class. Take notes and be prepared to give reasons for placings, if reasons are a part of the event.

did you know?

The heaviest hog ever recorded was a Poland China hog named Big Bill. He weighed 2,552 pounds and measured 9 feet long and 5 feet tall, with a belly that dragged on the ground.

Evaluation of the Class

A number of traits must be considered when evaluating a class of swine. These include conformation, size, muscling, finish, and reproductive soundness (Figure 16-8). Decisions are made based on whether the hogs in the class are for market or breeding purposes.

Placing Classes											
	Placing	Class								Placing	
		1	2	3	4	5	6	7	8		
1	1 2 3 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 2 3 4	1
2	1 2 4 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 2 4 3	2
3	1 3 2 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 3 2 4	3
4	1 3 4 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 3 4 2	4
5	1 4 2 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 4 2 3	5
6	1 4 3 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 4 3 2	6
7	2 1 3 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2 1 3 4	7
8	2 1 4 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2 1 4 3	8
9	2 3 1 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2 3 1 4	9
10	2 3 4 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2 3 4 1	10
11	2 4 1 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2 4 1 3	11
12	2 4 3 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2 4 3 1	12
13	3 1 2 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3 1 2 4	13
14	3 1 4 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3 1 4 2	14
15	3 2 1 4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3 2 1 4	15
16	3 2 4 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3 2 4 1	16
17	3 4 1 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3 4 1 2	17
18	3 4 2 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3 4 2 1	18
19	4 1 2 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4 1 2 3	19
20	4 1 3 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4 1 3 2	20
21	4 2 1 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4 2 1 3	21
22	4 2 3 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4 2 3 1	22
23	4 3 1 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4 3 1 2	23
24	4 3 2 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4 3 2 1	24
		1	2	3	4	5	6	7	8		

FIGURE 16-7

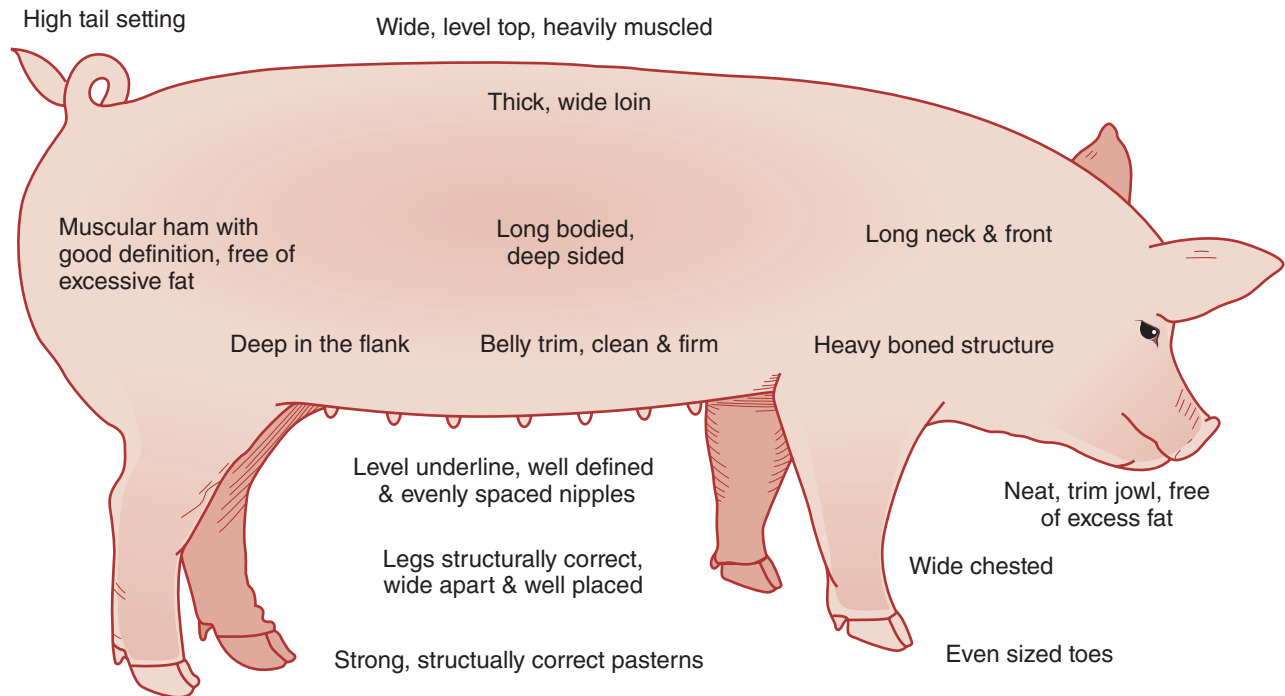
Example of a judging scorecard. This card provides for eight classes of four animals with four animals in a class. There are 24 possible rankings of the animals.

type

also called conformation; the overall appearance of the animal

Type, or conformation, is judged on the basis of length of the side and the skeletal size (scale). Body length is related to the growth rate and the future productivity of the sow.

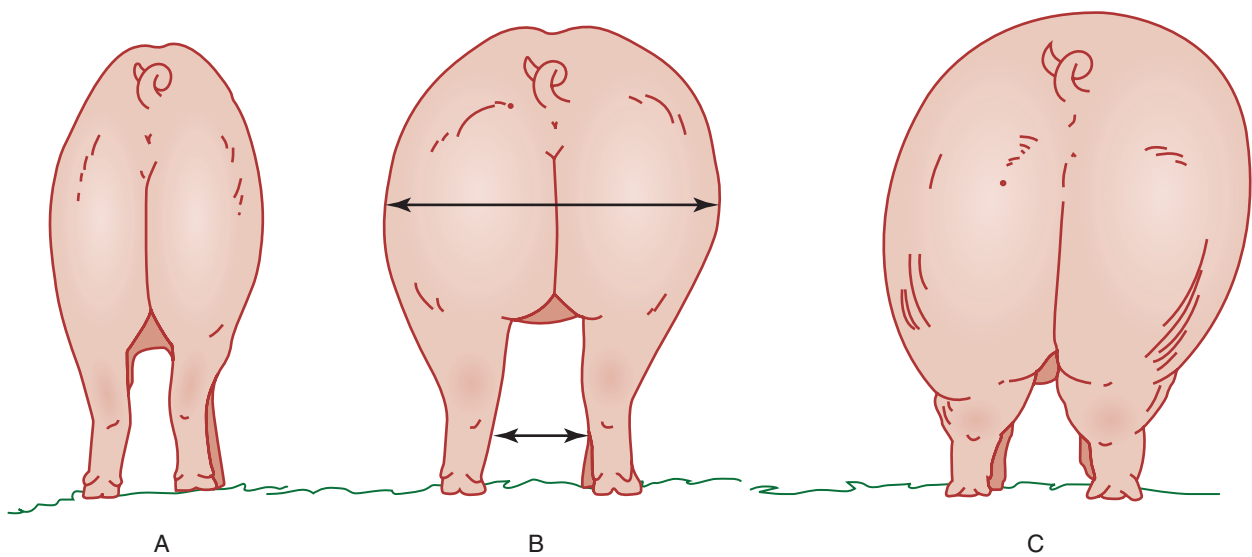
Muscling is best evaluated from the rear of the animal. The shoulders and ham should be wider than the back when viewed from above, indicating good



Delmar/Cengage Learning

FIGURE 16-8

Desirable traits in swine.



Delmar/Cengage Learning

FIGURE 16-9

Pig A is too narrow across the hams and between the legs, indicating a lack of muscle. Pig C is an old-fashioned type of market hog with little muscling and a lot of fat. Pig B is wide across the middle of the hams and has a wide stance of the legs indicating better muscling than Pigs A and C. Pig B is the best selection of this group.

muscling (Figures 16-9 and 16-10). Narrow hams and shoulders indicate poor muscling. Be sure the observed width is due to muscling and not to excess fat. A narrow stance at the back feet indicates either excess fat or light muscling.

finish

the amount of fat covering on the hog



Courtesy of Ray Herren

FIGURE 16-10

When viewed from above, a desirable-type hog should be wider at the shoulders and hams than the middle.

Finish refers to the amount of fat covering on the hog. The hog should have some fat covering, but not in excessive amounts. Indications of excess fat include a heavy jowl, shaky middle, square top, looseness in the ham and crotch, or a roll of fat over the shoulder. A good way to see if a hog is fat is to look down their backbone. Hogs that are not overweight and are well muscled in the loins will have a crease or dimple down their backbone, while hogs that are fat are flat on top with no crease.

All parts of the hog should be properly proportioned, or balanced. A well-balanced hog moves well with the correct levelness from the point of the shoulder through the hip. The feet and legs should be in good condition. Legs must not have any deformities and should move freely. The feet should be big, even-toed, and set squarely under the animal.

The underline of the pig is especially important when evaluating breeding animals. Breeding animals should have a straight, well formed underline with a minimum of seven functional nipples per side, for both boars and sows (Figure 16-6). Boars should also exhibit a good underline because this trait will be inherited by their offspring.

Figure 16-11 shows a typical barrow that might be one of four animals in a market hog class. Although we are only able to see him from the side, motionless, we can still tell a great deal about this



Courtesy of Ray Herren

FIGURE 16-11

A typical barrow that might be used in a class at a livestock judging event. This is an example of an excellent market hog with good dimension. This barrow would generally be in the top of his class.

animal. As a barrow, he is obviously a market animal, and he is near harvest weight. Overall, he is a very desirable type. He has a heavy structure, appearing to be broad-shouldered and wide-chested. This barrow is thick-bodied, being built wider from the ground up. He has good expression in the hip, and is thick through the ham and shoulder area. He is structurally correct out of both ends of the skeleton. His front feet placement is good, indicating proper structure. There is a good balance of fat to lean, and he is correctly finished. As for criticisms, three minor points can be made. The barrow appears to be slightly short-fronted and his hip is a little too steep. Also, this pig is a little high in the rear flank. It appears that this pig is level-topped, but because of the stance in the photograph, it cannot be determined for sure. This pig is a good example of a market hog with good dimensions that would generally be in the top of his class, depending on the other three pigs in the class.

Summary

Modern hogs are much leaner than those produced in the past. Most market hogs in the United States today are produced through crossbreeding programs.

The National Pork Producers Council describes the ideal market hog as Symbol III. Symbol III represents the goals of production, carcass merit, and quality that producers should strive to achieve.

Performance records, EPDs, are used by producers to help evaluate breeding stock and select animals with superior traits in order to improve genetics. In addition to performance records, other criteria used when selecting breeding stock include reputation of the producer and soundness of the animal. Hogs are judged on the basis of visual appraisal and performance data. Visual appraisal should focus on body conformation, size, muscling, finish, quality, and reproductive soundness.

Quick Facts

- A major factor in the price received for market hogs is lean value.
- The majority of market hogs in the United States are produced by crossbreeding programs such as rotational and terminal crossbreeding systems.
- The four primal (basic) cuts of the hog carcass are: ham, loin, Boston butt, and picnic shoulder.
- The National Pork Producers Council (NPPC) describes the ideal market hog as Symbol III, which is a representation of a model pig that producers strive to achieve.
- The ideal market hog has correctness of structure, production, performance, function, livability, attitude, health, and optimum lean yield.
- Breeding swine should be selected based on performance records, expected progeny differences (EPD), and visual inspection for structural soundness and general health.
- Participants in a swine judging contest look for a number of traits when visually evaluating swine, including body conformation, size, muscling, finish, and reproductive soundness.
- Contestants in a swine judging event rank four animals in a class from most desirable to least desirable, and may be called upon to give oral reasons.

Student Learning Activities

1. Visit a local commercial hog farm.
2. Learn how to calculate EPD's.
3. Have someone from the NPPC talk to the class about Symbol III.
4. Have someone experienced in judging swine talk to and demonstrate how to judge swine.
5. Have a person experienced in the swine selection process look at a group of hogs, then let students give reasons as to why they would choose the animal.

Discussion Questions

1. Contrast consumer demand today as compared with past demand for the typical market hog of the pre-1950s era.
2. Describe the goals for market hog characteristics represented by Symbol III.
3. Discuss factors other than performance records that should be considered when selecting breeding animals.
4. Briefly describe the important traits to consider when visually evaluating hogs.
5. What are the four primal cuts of a hog? Why are they important?

Review Questions

True/False

1. A low backfat measurement generally means a lower percentage of lean meat.
2. Modern pigs are different than hogs produced in the past.
3. The ideal market hog is labeled as Symbol II.
4. Genetic improvement is an important tool in keeping pork competitive with other sources of meat.
5. Backfat thickness is a good indication of body fat in pigs.

Multiple Choice

1. Muscling is best evaluated when viewing a hog from the _____.
 - a. side
 - b. rear
 - c. front
 - d. top
2. _____ refers to the physical structure and appearance of the animal determined by its skeletal structure.
 - a. Finish
 - b. Quality
 - c. Conformation (type)
 - d. Soundness

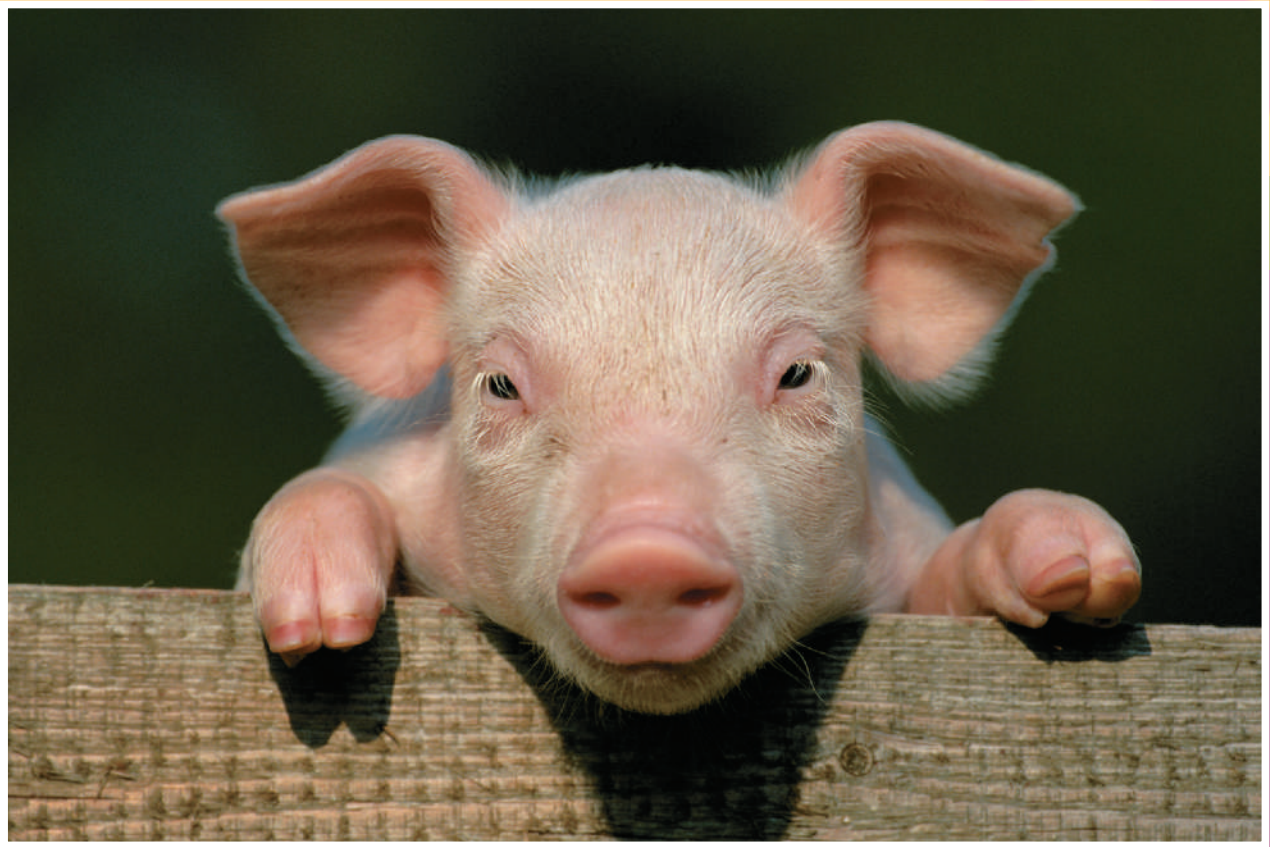
3. Which of the following is **NOT** one of the four primal cuts of a hog carcass?
 - a. sausage
 - b. ham
 - c. loin
 - d. picnic shoulder
4. The majority of market hogs in the United States are now produced through _____ crossbreeding systems because they tend to produce leaner pork.
 - a. terminal and rotational
 - b. rota-terminal
 - c. purebred
 - d. rotational and purebred
5. The amount of fat on a hog is called _____.
 - a. soundness
 - b. type
 - c. estimated breeding value
 - d. finish

Completion

1. In hogs, the underline should have a minimum of _____ nipples per side.
2. _____ is a technology used to measure the fat-to-free lean pork content of live hogs and carcasses.
3. The ideal market hog, referred to as _____, produces the best quality, safest pork that provides the optimum nutrients for human nutrition.
4. Market hogs today are much _____ than those hogs produced in the past.
5. When judging the muscling of a hog, the shoulders and ham should be _____ than the back when viewed from above.

Short Answer

1. Name the four primal cuts of the hog carcass.
2. How is ultrasound used in swine selection?
3. Why is a sound underline important when evaluating a boar?
4. Name the five traits used to evaluate a class of hogs.
5. What are some indications of excess fat on a hog?



CHAPTER 17

Fitting and Showing Swine



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe the general rules of swine shows.
- Describe the proper facilities that should be provided for show pigs.
- Select a show pig.
- Describe a show pig ration.
- Prepare a pig for show (washing, clipping, etc.).
- Exhibit a pig in the show ring.



KEY TERMS

ration
anthelmintic
Paylean[®]

clipping
health certificate

showmanship
bolt

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Groom	Palefrenier	Striegeln	N/A	Almohazar
Train	Dresser	Dressieren	Condocefacere	Entrenar
Judge	Juger	<i>Beurteilen</i>	Pendere	Evaluar
Entry Form	Formulaire d'inscription	Anmeldeformular	N/A	La Forma de Entrada
Weight	Poids	Gewicht	Pondus	El Peso

Introduction

Students choose to have swine projects for many reasons. It can be a way to gain leadership skills and develop responsibility. The process of preparing swine for the show ring is also known as fitting. Fitting includes feeding, exercising, training, washing, and clipping the swine. Showing swine teaches ethics, sportsmanship, and professionalism, in addition to being an enjoyable project (Figure 17-1).

Types of Swine Projects

There are generally two different types of swine projects for youth. These are market hog and breeding swine projects. Market hog projects are short-term. Market



Courtesy of Christy Bryan

FIGURE 17-1

Shows are competitive, fun, and educational.

hogs are ready for show and harvest at 5–6 months of age. Breeding swine projects are a longer-term investment if the pigs and offspring are to be returned to the farm.

Facilities for Show Pigs

With either a market or breeding swine project, the proper facilities must be available. Properly-sized housing based on the climate of the region must be considered, along with good fencing. It is necessary to have good fencing to define territory, for exercise, and to keep predators out.

Housing

Several factors should be considered when choosing a location for a hog facility, including zoning laws, adequate space for exercise, waste disposal, odor control, and location of water sources (Figure 17-2). A minimum of 60 square feet of pen space is needed for each pig. Of that, at least 24 square feet should be shaded to protect pigs from the sun. A housing shelter may be made of wood or various metals, such as aluminum. Floors can be made of concrete, dirt, or wood. Bedding can be pine straw or wood shavings. Make sure to clean the pens regularly and replace soiled bedding.



FIGURE 17-2

Permanent facilities for show hogs should be covered, and well-ventilated. A school-provided facility is shown here.

Fans and heat lamps are often needed to combat the elements. In cold climates, an enclosed area must be provided for protection from the wind and cold. White pigs should be kept out of the sun to avoid sunburn.

Selection of Show Pigs

When selecting show pigs, consider breed, age, pedigree, weight, sex, conformation, and soundness of the animal. Conformation and soundness should be the major factors to consider.

Breed

One breed is not necessarily superior to another. All breeds have their strong points and weaknesses. The breeds most commonly seen in livestock shows include Hampshire, Yorkshire, Duroc, Landrace, and crosses between these breeds. The breed selected to show is often simply the showman's personal preference.

Age/Weight

Show pigs are usually selected at 2 to 3 months of age and weigh around 50–60 pounds (Figure 17-3). The weight of the pig to purchase will vary according the



FIGURE 17-3

When choosing a show pig, look at many animals and take into consideration the conformation of each animal.

TABLE 17-1

Calculations for Making Weight for a Show Date

Beginning pig weight	Days needed before show to attain desired weight, generally 235–270 lbs.
40 to 55 lbs.	120 days
65 to 80 lbs.	105 days
90 to 105 lbs.	90 days
115 to 130 lbs.	75 days
140 to 160 lbs.	60 days

*This guide assumes healthy pigs on full-feed with an average growth rate of about 1.7 lbs. per day. Pigs with health problems or stresses such as heat and humidity will grow at a slower rate.

date of the show. Use an estimated daily rate of gain and a goal to select a pig that will make the show weight at the proper time. Table 17-1 shows some basic estimates for timing show weights.

Pedigree

Study the performance records and winning percentages of the parents of the pig being considered. Pigs selected from a line of pigs that have won shows in the past are usually a good choice, but may be more expensive (Figure 17-4).

When selecting a pig, make sure the porcine stress gene is not in the lineage. Porcine stress syndrome (PSS) is a genetic condition passed to the

**FIGURE 17-4**

With the right selection, nutrition, and environment, your pig could be in the winner's circle.

Courtesy of Ray Herren

offspring by the parents. Pigs with PSS have muscle tremors, twitching, etc., when stressed, which may result in sudden death of the affected animal.

Soundness

Look for proper muscling, fat, conformation, and structural soundness, especially of the feet and legs, of a prospective show pig. Examine muscling from the rear. Indicators of good muscling include well-developed hams, a wide stance in the rear, and a wide chest. Select a long-bodied pig that is deep-sided. The pig should take long strides and move with ease. Joints should be properly angled. Look at the animal from different positions as it moves. A beginner should obtain the assistance of an experienced person in selecting a show pig.

Nutrition

While genetics are important in selecting a show pig, this is only a starting point. It is the responsibility of the exhibitor to provide the necessary environment, nutrition, and training to ensure that the pig will be in the best shape on show day.

Basic Rations

A **ration** is a pig's daily allocation of food. Complex amounts of protein, energy feeds, vitamins, and minerals must be included in swine rations. Unless the handler has the special equipment and expertise needed to formulate his or her own swine rations, it is usually best to purchase complete commercial swine feeds.

Growing pigs should be allowed to eat all they want. Self feeders may be used initially (Figure 17-5). Hand feeding should be started at about 170 lbs. to control weight gain. To hand feed means to give the pig a specific amount of feed in a feed trough or

ration

daily food allocation



Delmar/Cengage Learning

FIGURE 17-5

Show pig feeders should be clean and in good working condition.

anthelmintic

medication to kill worms

Paylean®

a feed mix additive to increase muscle growth in pigs

pan each day. This method gives the producer more control over weight gain. Large-framed pigs may be self-fed for a longer time period than smaller-framed pigs. Feeders should be elevated so that the pig must hold its head up to eat. This strengthens the pig's neck muscles and trains the pig to hold its head up during the show. As the pig grows, feeders should be raised.

Pigs require different amounts of nutrients at different ages/weights. As pigs mature, they need less protein and fat. Feed companies produce different formulations of feeds for pigs based on their weight.

Additives

Some swine rations include low doses of medication. These medications may include antibiotics and **anthelmintics**. An anthelmintic is a medication given to the pig to kill worms. Be wary of withdrawal times, and be sure not use medicated feeds too close to show day.

Paylean® is a popular feed additive used in show pig rations. Its active ingredient, ractopamine hydrochloride, increases muscle protein synthesis, which results in lean swine carcasses containing more muscling and less fat. Paylean® is recommended to be used in the rations for the last 45–90 lbs. of gain in a market pig. There is no withdrawal time for Paylean®; however, it is not approved for use in breeding swine rations. Pigs being fed Paylean® are more susceptible to stress and should be handled with care.

Water

Water should be readily available at all times. Most hog exhibitors prefer to use automatic nipple waterers attached to a water source such as a hose, although some use pans or buckets (Figure 17-6). When using pans or buckets, exhibitors will need to refill them frequently with fresh water.

FIGURE 17-6

Commercial hog farms use automatic waterers, such as nipple waterers, that provide a constant supply of clean, fresh water.



Delmar/Cengage Learning

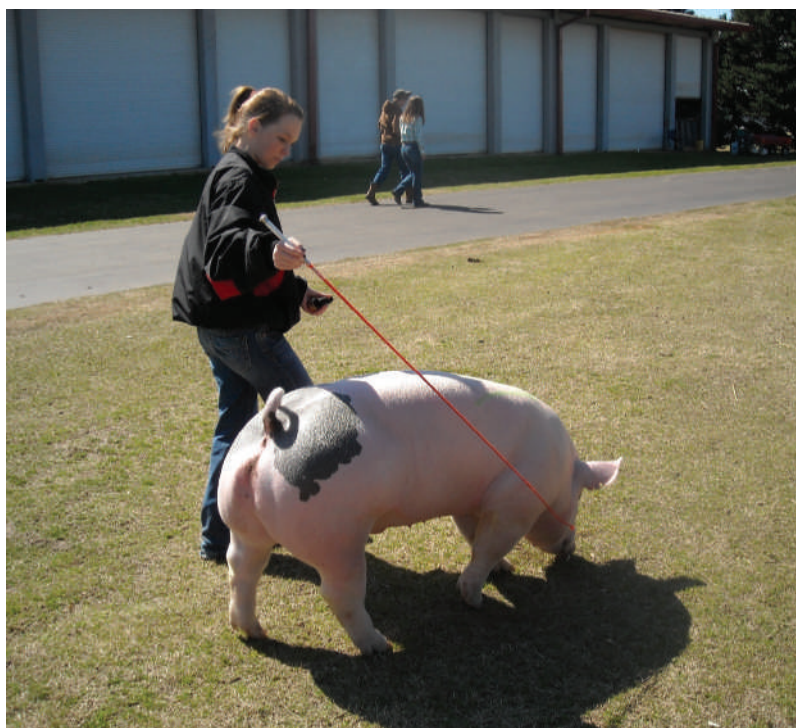
Training

Training a show pig is time consuming, but very important for success in the show ring. Basic skills in the control and showing of a hog will ultimately make the handler and the hog look good. Exhibitors learn these skills by working with the pig on a daily basis before the show. Exercising the pig by walking it every day will firm up its muscles, making it more appealing in the show ring.

Walking

Showing hogs is very different from showing other animals because it is done without the benefit of a restraint device like a halter. For this reason, it is more challenging, and more training is required. The handler should enter the pen several times a day for a few minutes to allow the pig to become acquainted with his or her presence. The handler may want to give the pig treats. The pig should be touched often by brushing, scratching, etc.

Exercise should begin at least two months prior to the show (Figure 17-7). Walk the pig 3–5 times per week for about a half mile. To avoid heat stress, only exercise the pig during the coolest part of the day.



Courtesy of Kayla Calhoun

FIGURE 17-7

Daily walking of the pig helps the animal become familiar with the show process.

Begin to work the pig with a show stick. To get the pig to move forward, tap it in front of the shoulder. To get the pig to turn, gently tap it on the jowl with the stick. Pick an object to be the “judge,” such as a tree, and practice driving the pig at different angles around that object, as would be done around the judge.

Once the pig learns basic commands, it is good to train it to be comfortable around other pigs. Walk the pig with other pigs together in a pen if able (Figure 17-8).



Courtesy of Christy Bryan

FIGURE 17-8

Exhibitors should practice walking and handling their pig with other pigs and exhibitors prior to the show.



FIGURE 17-9

There are several different kinds of show sticks available for use with show pigs.

Types of Show Sticks

Different shows have varying rules on show sticks, whips, or other instruments to drive the pig. Check to make sure that you are using a show stick that is in accordance with the rules for your particular show. Light riding-whips, hard sticks, fiberglass rods, walking canes, etc., are some examples of instruments to drive the pig. Recently, the trend has been to use a show stick with a small flap on the end to minimize injury to the pig. Use the same instrument at home as is used in the ring so the hog will be familiar with it and will respond in a predictable way (Figure 17-9). No matter what instrument is used, be sure to use it only to guide the pig in a humane way.

Show Preparation

The swine show rules and tips mentioned here are very general, and may not apply to shows in all areas of the country. To determine current trends in showing, consult your local agriculture teacher or county extension agent. Show rules may be found online or in a printed premium book.

Grooming Rules of Swine Shows

In most swine shows, exhibitors cannot use adhesives, glue, paint, oil, or powder products for grooming. No stiff, sticky products may be used. It must be possible to run a comb through the animal's hair. All products used must be water-soluble.

The packing industry has expressed concern for the high number of hogs with short clipped hair they receive from shows. Clipping hair too short makes it difficult and more expensive for packers to remove the hair during processing. A general minimum hair requirement is 1/2". The Youth PQA Plus Program discourages clipping of show pigs.

A good practice, especially as an alternative to body shaving and clipping, is daily brushing of the hair on the pig. Daily brushing and an occasional washing will make the hair shine and result in rewards in the show ring. It is the exhibitor's responsibility, whether the pig is clipped or not, to assure that the pig meets hair requirements for the show.

Washing and Rinsing

The first step in preparing a pig for show is washing. Start washing the hog about 3 weeks prior to the show to get it used to being washed. At the show arena, there are usually wash racks specially set up for washing the pigs. Washing is also necessary prior to clipping (Figure 17-10).

Rinse the pig first to get rid of big chunks of dirt and debris. Next, pour soap into the water stream from the hose or use an attachment to dispense soap or shampoo (Figure 17-11). To avoid stress, do not wash or spray the hog's head until the rest of its body has been washed (Figure 17-12). Do not get water inside the hog's ears. Pigs have sensitive snouts; wash them with a rag rather than a brush. Also use a wet rag to clean the inside of the ears. The feet and legs are often the most difficult to clean (Figure 17-13). A good livestock shampoo or soap and a good scrub brush are most effective.

FIGURE 17-10

Before washing, a pig should be rinsed to remove dirt and debris.



Courtesy of Kayla Calhoun

FIGURE 17-11

Use livestock soap to clean the pig. A soap dispenser may be used to release soap and water together, which makes cleaning easier. Make sure to thoroughly rinse the pig.



Courtesy of Kayla Calhoun

FIGURE 17-12

To avoid stress, do not wash or spray the pig's head until you have finished washing the rest of its body.



Courtesy of Kayla Calhoun

FIGURE 17-13

The feet and legs are often the most difficult to clean. A soft brush may be necessary to clean the feet and legs.



Courtesy of Kayla Calhoun

Supplies

Basic supplies for a show include soap or shampoo, a scrub brush, a small brush to keep in the pocket, rubber boots for washing, a water hose, rags, show stick, rubber feed pans or fence feeders, feed, water dispensers or pans, and a small spray bottle. If the show allows, the handler may also want to bring other grooming supplies, such as a light oil spray for dark colored hogs. Experienced showmen usually store their supplies in a show box with their names painted neatly on it. If the show allows, the handler may want to take extra bedding. Some shows have “official” bedding that must be used, so be sure to comply with those rules.

Clipping

clipping

trimming the hair of an animal

Clipping refers to the trimming of a pig’s hair in preparation for show day. Clipping should be done at home within a week of the show date. Many shows have rules regarding how short to clip the pig’s hair. Pigs are clipped to create a youthful, fresher appearance, and also to enhance muscle tone perception. Make sure the hog is clean. Dirt and debris in the hair can dull clippers quickly. Sometimes a restraint system is used to hold pigs for clipping. This causes a lot

of stress on the pig. For this reason, most shows have banned the use of restraint devices and clipping on the show grounds. The exhibitor should work with the pig daily so that the pig is thoroughly at ease around people. The pig that is at ease around people is more likely to stand for grooming and clipping.

Begin by clipping the back first (Figure 17-14). Clip against the grain of the hair.

Next, clip one side at a time, moving from the ham to the side to the shoulder (Figures 17-15 and 17-16). Use small clippers on the inside of the legs and the face (Figures 17-17 and 17-18).

Several techniques may be used to improve hog appearance. Blending along the edges between shorter and longer clipped hair helps reduce the

FIGURE 17-14

Start clipping on the back, and clip against the grain of the hair using large clippers if available.



Delmar/Cengage Learning

FIGURE 17-15

Clip each side, starting at the ham and blending into the back. Work forward to the shoulder of the hog.



Delmar/Cengage Learning

FIGURE 17-16

Clip each shoulder of the hog up to the face.



Delmar/Cengage Learning

FIGURE 17-17

Use smaller clippers on the feet and legs. These are easier to maneuver between the legs.



Delmar/Cengage Learning

FIGURE 17-18

Use smaller clippers on the face. Be careful not to get clipped hair into the pig's eyes.



Delmar/Cengage Learning

obviousness that a pig has been clipped. Shaping refers to clipping the hair of a hog in a way that enhances muscle visibility.

Documentation for Shows

Each show may have different requirements for the show animals and the exhibitors. Make sure to check the premium book for guidelines and abide by all the rules and regulations of the show. All local, state, and federal regulations should be followed.

Identification Methods

Ear notching has been discussed in previous chapters. Many shows prefer ear tags over ear notches. Ear tags provide quick and easy identification of pigs. Know each pig's ear tag number. Make sure the correct numbers are listed with the correct pig on entry forms.

Registration Papers

Animals in breeding classes must be recorded in recognized pedigree record books for their respective breeds. Exhibitors should have certificates of registration readily available in case the show superintendent requests them.

Health Papers

All animals entered in any type of livestock show must have an official certificate of veterinary inspection. This **health certificate** should be issued within 30 days of the exhibition. Market hogs may not be required to have a certificate of veterinary inspection if there are no breeding animals on the premises.

health certificate

a document from the veterinarian stating that the animal is in good health and can be transported to the show grounds

Entry Forms

Each exhibitor must sign a liability/rules acknowledgment statement for most shows. If the exhibitor is a minor, a parent or legal guardian must sign the forms.

Show Day

Preparing for show day takes special preparation. Make a list of items to take to the show, and prepare for the care of the animal that must be given at the show.

Pens

Pens at fairs or commercial shows are usually 6–8 square feet in size (Figure 17-19). This is large enough to comfortably accommodate three to five hogs. Sometimes the show will provide their “official” bedding, such as shavings, straw, etc., and sometimes the exhibitor must provide it. Check the show rule-book for guidelines regarding “official” bedding to see if/how much will be provided and plan accordingly.

Feeding

On the day of arrival at the show, give pigs 1/2 their normal ration and lots of fresh water. When worried that the pig won’t make weight, feed it more than its normal ration in the few days before weigh-in. Similarly, if the exhibitor is worried that the pig will weigh too much, withhold part of the ration. However, never withhold water.



FIGURE 17-19

Pens at shows should be sturdy enough to contain your show pig.

There are complete mixed feeds available specifically for use the night before and the day of a show. The purpose of these feeds is to keep show pigs alert and hydrated, while enhancing muscling and expression.

Pigs need to be well-hydrated at all times to prevent stress and dehydration. If the pig will not drink, add some flavoring to the water.

Grooming

Clipping is usually not allowed at the show, due to the excessive noise caused by squealing pigs. If grooming sprays are not allowed, the handler can “show wet,” or mist the pig with water before entering the ring. Brushing the pig is always advisable to make the hair look its best, and to help keep it clean.

Weight Classes

Hogs are usually divided into classes based on their weight at weigh-in. The number of classes and pigs in each class are determined by the number of entries. Depending on the size of the show, classes may also be grouped into divisions. If a pig wins a class, it will move on to the division finals, and then to the overall finals.

Showmanship

While the weight classes emphasize the characteristics of the hog, showmanship competitions focus on the abilities of the exhibitor. **Showmanship** events involve the overall training, care, appearance of exhibitors and their animals, and the exhibitor’s ability to show off the animal to its best advantage. During showmanship, the time and effort in working with the pig prior to the show will be obvious.

Good showmanship should be exhibited whether in a market class, breeding class, or during the showmanship class. Good showmanship helps present the exhibitor and the animal in the best possible light. The judge is influenced by the exhibitor’s actions, appearance of the animal and the exhibitor, and the behavior of the animal.

showmanship

the overall ability of the handler
to show an animal off to its best
advantage



Courtesy of Christy Bryan

FIGURE 17-20

Proper attire for the show ring includes clean, pressed jeans, button-down shirt, and closed-toe shoes. Exhibitors should be neat in appearance.

Regular and thorough training at home is a must for show preparation. Daily feeding, care, and walking/driving of the pig creates a bond that will extend to the show ring. Swine exhibitors always fear that their pig will be the one to be stressed and run around the ring, out of control. While this may happen to anyone, good training at home will generally pay off at the show. Poor training, or a lack of training, is almost always certain to be revealed by an out-of-control or poorly controlled pig in the ring.

Exhibitors should be clean and well-groomed. While styles of dress change over the years and by regions of the country, certain basic guidelines of good personal grooming and neatness should be followed. A collared, ironed shirt, tucked in with a belt, and ironed, non-faded jeans with boots are generally appropriate (Figure 17-20). Females usually tie long hair back. Brightly colored shirts are sometimes recommended to help attract the attention of the judge.

Beginners, as well as experienced exhibitors, should observe other classes, the ring layout, and actions of the judge before their class shows if possible. Before entering the ring, some exhibitors spray their pig lightly with water from a spray bottle to give it a fresh look. Exhibitors should keep a brush in their back pocket for use in the ring. Spray bottles should not be carried into the ring. Occasionally, a judge may sprinkle shavings on the pig, to determine how observant the exhibitor is about his or her pig's appearance. Pigs may need an occasional brushing in the ring to look their best.

The objective of an exhibitor is to present his or her pig to its best advantage. The pig should be kept between the exhibitor and the judge (Figure 17-21). The exhibitor should strive to stay 10 to 20 feet away from the judge, and should be in a slightly crouching position with knees bent. Showmen should appear calm and confident at all times, keeping one eye on the judge and the other on the pig. The exhibitor must anticipate movement of his or her pig as well as that of the judge and act accordingly. The pig should be kept moving at a steady pace around the ring.

FIGURE 17-21

Keep your eye on the judge while controlling your animal, with the animal between you and the judge.

bolt

a sudden unpredictable action of running



Courtesy of Kayla Calhoun

Pigs are not restrained in the show ring and may act unpredictably. Pigs occasionally **bolt** and run around the ring—a major fear of exhibitors. If a pig bolts, the exhibitor should calmly walk over to it and resume driving the animal around the ring. Pigs should be kept out of the corners and away from other pigs.

Never touch the show pig with the hands. Be courteous; if another pig cuts in front, allow it and its owner to pass. Stay out of groups of pigs to avoid fighting. The handler should position himself or herself on the side of the pig away from the judge near the flank and ham/loin juncture. This position is best for anticipating and controlling pig movement.

Use of the show stick is important. The stick is used to gently tap and drive the pig, not to hit. The stick should be held in the hand closest to the hog. The pig should be tapped on the point of the shoulder around the jowl to encourage movement. The stick should not be used on the back or hip. This may cause the hog to arch its back or drop its rear end. Only the show stick should be used to guide the animal—not the hands, knees, or other parts of the exhibitor's body. Use the show stick sparingly. Too much use of the show stick indicates a lack of training. Anger, hitting with the stick, or other inappropriate actions are objectionable to the judge and audience. Inappropriate actions may result in dismissal from the show.

FIGURE 17-22

Being courteous, sportsmanlike, and respectful of others in the show ring is important.



Courtesy of Christy Bryan

Occasionally, a judge may give special instructions. The judge may ask exhibitors to swap pigs. The exhibitor should be prepared to swap equipment as the equipment goes with the pig.

Occasionally, a judge may ask an exhibitor questions. Typical questions address ear notching, date of birth, weight, feeding program, breed/name, and structural qualities of the pig.

The exhibitor should be prepared to pen their hog if directed by the judge. Exhibitors should be gracious in winning and always thank the judge (Figure 17-22). A handshake and “thank you” are always appreciated and reflect well on the exhibitor’s character.

Summary

The two types of swine show projects are breeding animals and market hogs. The show premium guide for each show should be consulted for complete rules and regulations. Showmanship is an important part of showing swine.

An exhibitor should consider several factors before purchasing a show pig, including breed, age/weight, sire, sex, soundness, and the current standards for an ideal market or breeding hog. Age and weight can also be used to set weight-gain goals before formulating a ration. Most exhibitors use complete commercial feeds.

There are several techniques and tools used to train a pig. Hog health can be maintained by periodical washing, hoof care, disease prevention

and treatment, and maintaining sanitary conditions. Training and preparation will pay off in the show ring.

Before a show, an exhibitor should gather basic supplies, clip pigs, and be sure to obtain all of the required documentation. On show day, feed rations may be altered. Pigs should be clean and well-groomed. In the weight classes, pigs are judged based on their physical characteristics. In the showmanship classes, the focus is on the appearance of both the exhibitor and the show pig, and the training and preparation exhibited by each.

Quick Facts

- Show pigs are divided into two main types of projects: breeding animals and market hogs.
- Clipping hair shorter than 1/2" makes it difficult and more expensive for packers to remove the hair.
- Medicated feeds are sometimes used to control diseases and parasites, but they have a withdrawal time that must be strictly observed.
- Paylean[®], a popular feed additive used in show pig rations, increases muscle protein synthesis, which results in lean swine carcasses containing more muscling and less fat.
- If a pig weighs too much the week of a show, a portion of the ration can be withheld to control weight, but water should be provided at all times.
- Hogs are shown without the use of restraint devices.
- Pigs are moved by tapping them on the shoulder-jowl area with the show stick.
- Exhibitors should always maintain eye contact with the judge when in the show ring.
- When in the show ring, pigs should be kept moving at a steady pace and placed between the exhibitor and the judge.
- In the showmanship event, emphasis is placed on the ability of the showman to display the animal to its best advantage.
- Commercial feeds, especially formulated for show pigs, are generally recommended and used by exhibitors.
- Beginning showmen should obtain assistance from experienced persons who can help them to select a show animal and to prepare for the show.
- Show rules and regulations vary across the country, and from show to show.
- Clipping pigs for show should be done at home, as clipping is not allowed on-site at most shows.

Student Learning Activities

1. Have students take turns asking questions that a judge might ask in the show ring.
2. Using weight and rate-of-gain information, have students calculate how much feed to give an animal daily until show day. (Assume a constant rate of gain.)
3. Have a professional showman explain to students how to groom a pig.
4. Have someone experienced in showing pigs demonstrate proper showing methods to students.
5. Visit a local show and watch the market hog class.

Discussion Questions

1. What are the advantages of using Paylean[®]?
2. What are some basic supplies that should be included when packing for a show?
3. What kinds of questions might a judge ask an exhibitor in the show ring?
4. Explain why processors do not like the hair of show pigs to be clipped short.
5. When should exhibitors start washing pigs at home? Why?

Review Questions

True/False

1. White pigs should be exposed to as much sunlight as possible to encourage proper metabolism.
2. Show pigs should always be tapped with the show stick rather than hit.
3. When in the show ring, you should never touch your pig with your hands.
4. Exhibitors often use their knees to move their hog in the show ring.
5. Oil-based hair products are allowed at most shows.

Multiple Choice

1. To get your pig to move forward, _____.
 - a. tap it on the jowl
 - b. tap it behind the front shoulder
 - c. hit it on the back
 - d. nudge it with your knees
2. In order to avoid stress, the pig's _____ should be washed last.
 - a. feet
 - b. back
 - c. head
 - d. ham
3. After clipping, a pig's hair should be at least _____ long.
 - a. 1/2"
 - b. 1/4"
 - c. 1"
 - d. 2/3"
4. Paylean[®] is a feed additive that _____.
 - a. reduces stress
 - b. increases muscle protein synthesis
 - c. fights infections
 - d. increases fat production
5. Good showmanship methods are important for _____ classes.
 - a. market
 - b. breeding
 - c. showmanship
 - d. all of the above

Completion

1. Paylean[®] is not approved for use in _____ swine rations.
2. When choosing a location for a swine facility, one should consider zoning laws, adequate space for exercise, waste disposal, odor control, and location in regard to _____ sources.
3. When housing pigs, a minimum of _____ square feet of pen space is needed for each pig.

4. Sunburn is most often a problem with _____ hogs.
5. The overall training, care, and appearance of showmen and their animals, and the ability of the showman to display their animal is called _____.

Short Answer

1. What must be included in swine rations?
2. Why is it important to keep feeders elevated?
3. What four breeds are most often seen in livestock shows?
4. What should you do if the judge sprinkles shavings on your pig in the show ring?
5. What should you do if your hog runs away from you in the show ring?



Section 6

SHEEP AND GOATS

CHAPTER 18 Introduction to Sheep and
Goat Production

CHAPTER 19 Management of Sheep and Goats

CHAPTER 20 Fitting and Showing Sheep
and Goats

FFA AND 4-H CONNECTION



The following is a partial list of activities in which a student may participate using knowledge obtained in a sheep or goat program. Students should consult local and state youth organizations, such as the National FFA Organization and 4-H, to determine livestock-related programs available in their area.

- Agricultural Marketing
- Agricultural Sales
- Agriscience Fair
- Animal Nutrition
- Food Science and Technology
- Junior Market Goat Shows
- Junior Market Lamb Shows
- Livestock Evaluation
- Meats Evaluation and Technology

Proficiency Awards (FFA)

- Diversified Agricultural Production
- Diversified Livestock Production
- Sheep Production
- Specialty Animal Production
- Veterinary Medicine





CHAPTER 18

Introduction to Sheep and Goat Production



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe the major characteristics of sheep and goats.
- Classify sheep and goats by type and use.
- Identify the common breeds of sheep.
- Identify the common breeds of goats.
- Discuss the characteristics of the sheep and goat industry.



KEY TERMS

range production
farm flock
production
lamb
mutton
mixed grazing

micron
staple
lanolin
fleece
banding (flocking)
instinct

chevon
dual-purpose
mohair
browse

LANGUAGE CONNECTION

English	French	German	Latin	Spanish
Goat	Chèvre	Ziege	Capra	La Cabra
Sheep	Mouton	Schaf	Ovis	La Oveja
Kid	Enfant	Jungziege	Haedus	El Cabrito
Lamb	Agneau	Lamm	Agnus	El Cordero
Wool	Laine	Wolle	Lana	La Lana
Milk	Lait	Milch	Lac Lactis	La Leche
Fleece	Toison	Vlies	Vellus	El Vellón

did you know?

Goats and sheep can look a lot alike, and sometimes it is difficult to tell them apart. The easiest way to tell whether an animal is a sheep or a goat is by looking at its tail. Goats carry their tail up unless they are not feeling well. Sheep carry their tails down all the time.

range production

the raising of sheep in large flocks that are free to roam over large tracts of land

farm flock production

the raising of small flocks of sheep that are usually kept on good pasture and may be fed grain and other supplements

Introduction to Sheep and Goats

Sheep and goats are two of the oldest known domesticated livestock species. They provided meat, fiber, and milk to early nomadic people living in Eurasia. Both sheep and goats are ruminants. They are similar in size and care requirements, and have historically been raised together. Although sheep and goats resemble each other, they are different species, and some distinctions need to be made.

Overview of the Sheep Industry

Sheep are raised in every state in the United States. **Range production** is concentrated in twelve western states, while **farm flock production** is found in the rest of the states (Figure 18-1). In range production, sheep are raised in large flocks and are free to roam over large tracts of land. Usually, the land is dry and has limited vegetation. Sheep can utilize this type of agricultural land where other species would not survive. These animals can usually thrive by grazing on the open range. They do not require much, if any, grain. Farm flock production, on the other hand,



Courtesy of Dr. Jennie Osborne

FIGURE 18-1

Most farm flocks are less than 100 head. They account for 90 percent of sheep operations but only 50 percent of the production.

is a way of raising sheep on a small scale, where the animals are usually kept on better pasture and may be fed grain and other supplements. Small farm flocks of fewer than 100 head account for about 90 percent of sheep operations in the United States. Range production, making up about 10 percent of all operations, accounts for over 50 percent of the total U.S. sheep production. Large commercial flocks of over 500 head account for less than two percent of all operations, but produce the majority of the lambs and wool in the United States.

In the United States, most sheep and lambs are meat-type animals kept mainly for the production of meat. Dual-purpose breeds are kept for both the production of meat and wool. Almost all sheep harvested in the United States are **lambs**, young sheep under 12 months of age. Although there is a grading system in place for the carcasses, it is rarely needed since there is generally no problem with quality and tenderness because the lambs are so young when they are harvested. Lamb carcasses are usually similar in size and quality. **Mutton** is the meat of a female (ewe) or castrated male (wether) sheep that is over one year of age.

lamb

young sheep under 12 months of age

mutton

the meat of sheep over one year of age

Industry Terminology: Sheep

ram	=	intact male sheep
ewe	=	female sheep
wether	=	castrated male sheep
lamb	=	young sheep
lambing	=	giving birth to sheep
flock	=	group of sheep

Total sheep numbers in the United States has declined in the past several years. Australia, New Zealand, and China are the major world producers of sheep. In the U.S., most lambs being fed for harvest are concentrated in large commercial feedlots. The leading state in the numbers of sheep and lambs on feed is Colorado, although many smaller feedlots are scattered across the country. Approximately 80 percent of lambs are processed at plants in Colorado, California, Iowa, Michigan, and Illinois.

Several factors have contributed to the decline in the sheep industry in the United States in recent years. These include:

- ▶ Low per capita consumption – the consumption per person for lamb and mutton per year is about two pounds compared to a per capita consumption of eighty pounds of beef.
- ▶ Low wool prices—the use of artificial fibers instead of wool in clothing and competition from producers in other countries has reduced sheep production in the U.S.
- ▶ Sheep are susceptible to internal and external parasites that are becoming more resistant to pesticides.
- ▶ Problems with predators. The re-introduction of the wolf to western states, as well as an increase in the number and range of coyotes and dogs, has contributed to a decrease in the sheep population.
- ▶ High labor requirements and a lack of skilled labor.

**FIGURE 18-2**

Cattle and sheep are sometimes placed together in a mixed grazing system.

mixed grazing

raising two different livestock animals together on pasture

Mixed grazing, or raising cattle and sheep together, has proven to produce more meat from the same amount of land (Figure 18-2). Mixing cattle and sheep together on the same pasture is beneficial to the rancher because the sheep prefer to eat plants that the cattle will not eat. Mixed grazing is most prevalent in the Northern Plains States and Texas.

Sheep make a good second enterprise on a farm because:

- ▶ The initial costs are low.
- ▶ Sheep do not require expensive housing or equipment.
- ▶ Sheep make use of rough land unsuitable for other agricultural use.
- ▶ Sheep can be fed on pastures and roughages, and only require small amounts of grain.



Geography Connection

Many sheep shearers work in both the Northern and Southern hemispheres due to the alternating seasons. In the U.S., shearing is usually done in the spring so that the sheep don't get overheated in the summer. When it is time to shear sheep in the United States, the shearers have finished with the flocks in Australia and New Zealand and fly to the U.S. just in time for shearing season. They travel across the U.S. shearing sheep, and then they fly back home for the beginning of the shearing season in the Southern hemisphere.

did you know?

When getting ready to shear mixed or crossbred sheep for wool production, the shearers always shear the white-headed and black-headed animals separately. This is because buyers consider the wool of white animals to be of higher quality, above black or any other color. They will not accept a mixture of the two colors of wool.

micron

a unit of length in the metric system that is one millionth of a meter

staple

fibers of the wool graded by length

Breeds of Sheep

Sheep breeds have been developed for three major purposes: wool, meat, and milk. Sheep produce fine wool for high-quality clothing and long wool for upholstery and rugs (Figure 18-3). Sheep's milk is a major source of protein in countries around the world, especially in developing countries. In the U.S., sheep are used for meat and wool, but occasionally for milk. Sheep are commonly classified by their primary purpose: wool or meat. For wool purposes, sheep are classified by the type of fibers they produce—fine, medium, long, and hair.

Sheep are technically described as seasonally polyestrous in their breeding patterns. In other words, they will come into heat (have an estrus cycle) many times during a season. The possibility exists for many breeding cycles, but most sheep breed only in the fall and winter months, and lamb in the spring. They are known as short-day breeders. The ratio of light to dark in a 24-hour period is an important control in the physiological responses of reproduction.

Fine Wool Breeds

Fine wool sheep produce wool fibers with a very small fiber diameter, 20 **microns** or less. The diameter of the wool fiber is directly related to the itchiness of the wool. **Staple** is the grading of the fibers

FIGURE 18-3

Wool prices have continued to drop with the invention of artificial fibers for clothing. Pictured is a comparison of long and short fiber wool.



Courtesy of USDA

of wool by length. Long-staple wool is the most valuable wool from the fleece. Fine-staple wool fibers give greater comfort. Fine wool sheep account for more than 50 percent of the world's sheep population.

lanolin

a greasy yellow waterproofing substance secreted by the sebaceous glands of wool-bearing animals

did you know?

Lanolin is a greasy yellow substance secreted by the sebaceous glands of wool-bearing animals. Lanolin is found in many human products including hair products, cosmetics, and skin ointments. Lanolin's waterproofing ability helps sheep shed water from their coats. Certain breeds of sheep produce large amounts of lanolin, and extraction of this substance can be performed by squeezing the sheep's harvested wool between rollers. Most or all of the lanolin is removed from the wool when it is processed into textiles.

Two of the most popular of the fine wool breeds in the world are the Merino and the Rambouillet. They produce a fine wool fiber that has a heavy lanolin content. Originally, these breeds did not produce good meat carcasses but their wool was more valuable. However, through selection and breeding, the quality of their carcasses has been improved. Even so, these breeds are still used primarily for wool production. They have a strong flocking instinct. A high percent of sheep in range production areas are fine wool breeds. They have the ability to do well on poor-quality rangeland. An advantage of fine wool breeds is that they will breed out of season and can thus produce lambs in the fall months.

Merino Although not as popular as the Rambouillet in the United States, the Merino is very popular in other countries around the world (Figure 18-4). Merino sheep originated in Spain. They were first imported into the United States in 1793, and are the base animal of the world's fine wool market. The ewes are exceptional



Courtesy of American Delaine and Merino Association

FIGURE 18-4

Polled Merino ram.

fleece

the wool of one sheep or the wool of a similar animal

mothers. The wool of Merinos is in high demand around the world, earning its nickname the “Golden Fleece.” A **fleece** is the woolen coat of one sheep.

Merino	
Origin	Spain
Brought to U.S.	1793
Purpose	Wool and meat

Rambouillet The Rambouillet is the most popular breed among the fine wool producers in the United States (Figure 18-5). They originated in France and are closely related to the Merino. The first importations into the United States took place around 1840. One-half or more of the crossbred sheep in the United States carry some Rambouillet genes. The breed is particularly popular in the Western states. They produce a meatier carcass than the Merino, but it is not as good as the carcass of the breeds that have been bred for meat production.

Rambouillet	
Origin	France
Brought to U.S.	1840
Purpose	Wool and meat



Courtesy of Dr. Richard Coffey

FIGURE 18-5

Rambouillet sheep originated in France and are closely related to the Merino breed.

Medium Wool Breeds

The most common medium wool breeds are Suffolk, Hampshire, and Dorset. Medium wool breeds are mostly bred for meat production, and wool production is secondary. The fleece is medium in fineness, with a length of 20–36 microns in diameter. Medium wool breeds are popular both on the range and for farm flocks.

Suffolk Suffolk sheep are a relatively large breed that was developed in England (Figure 18-6). Suffolks are well-known for high-quality meat. The breed was only recently introduced to the United States, but it has many desirable qualities and is becoming widely accepted. Suffolks have bare heads, black faces, and bare black legs with only relatively light fleece coats. Suffolk rams are widely used in crossbreeding programs to produce lambs for meat production.

Suffolk	
Origin	England
Brought to the U.S.	1888
Purpose	Meat breed

Hampshire Hampshire sheep are large-build sheep originally bred in Hampshire, England (Figure 18-7). Hampshires have black faces and legs, with a white wool cap on their heads, and are characterized by



FIGURE 18-6
Suffolk ewes.

FIGURE 18-7

A National Show Grand Champion Hampshire ram.



Courtesy of the American Hampshire Sheep Association

rapid growth. Recognized as one of the most popular meat breeds, Hampshires are raised all over the world and are one of the leading breeds in the United States because of their ability to efficiently convert forage into meat and fiber. Hampshires are adaptable and are located in a wide range of geographic regions.



Courtesy of USDA

FIGURE 18-8

A flock of Dorset ewes in the western U.S.

Hampshire	
Origin	England
Brought to U.S.	1860
Purpose	Meat breed

Dorset The Dorset originated in southern England (Figure 18-8). These sheep have white heads and legs. The breed was developed in the early 1800s, with the first importations into the United States around 1887. They produce a muscular carcass. The ewes will breed out of season, so fall lambs can be produced.

Dorset	
Origin	England
Brought to U.S.	1887
Purpose	Meat breed

TABLE 18-1

Medium Wool Breeds

Breed	Purpose	Origin
Cheviot	Crossbreeding and meat	England/Scotland
Finnish Landrace	Crossbreeding, wool and meat	Finland
Montadale	Meat	United States
Oxford	Meat breed	England
Shropshire	Meat breed	England
Southdown	Meat breed	England
Tunis	Meat breed	Africa

Additional medium wool breeds are listed in Table 18-1.

Long Wool Breeds

The most popular long wool breeds are the Lincoln and the Romney. These breeds were developed in England and are larger than other breeds. They produce long, coarse-fiber wool used to make rugs and upholstery fabric. They are hardy and prolific, but tend to mature later than other breeds. The long wool breeds are listed in Table 18-2.

TABLE 18-2

Long Wool Breeds

Breed	Purpose	Origin
Cotswold	Wool	England
Lincoln	Wool	England
Romney	Wool	England

Crossbred Breeds

The crossbred breeds are bred for dual purposes—wool and meat. Most of the crossbred breeds were developed by crossing long wool with fine wool breeds. Crossbred wool breeds were developed mainly to improve carcass quality and the length of the wool fiber. These breeds have a better **banding (flocking) instinct** than either the long wool or medium wool

banding (flocking) instinct
tendency of sheep to stay
together in a group called a band
or flock

TABLE 18-3

Crossbreeds

Breed	Purpose	Origin
Columbia	Crossbreeding/ Meat/Wool	United States
Corriedale	Wool/Meat	New Zealand
Polypay	Wool/Meat	U.S.
Targhee	Wool/Meat	U.S.

breeds. Banding is important in large range areas so that the sheep will stay close to one another. Guardian animals such as dogs and donkeys are better able to protect the flock from predators if the sheep band together. Crossbreeds are well-adapted to the western range, but are also popular in the Corn Belt states. The most common cross is a Rambouillet ewe and a Suffolk ram in commercial operations. Common crossbreeds are listed in Table 18-3.

Hair Sheep Breeds

The hair sheep breeds include the Barbados Blackbelly and Dorper. These breeds have coats of hair, not wool. The coat may thicken in the winter, but will typically shed in warmer months. These sheep are primarily from the tropics and have been of great interest recently due to the low value of wool in the U.S. These sheep do not have to be sheared and are raised for meat production. Hair sheep have good parasite resistance because they have developed in areas where parasites are widespread.

Barbados Blackbelly The Barbados Blackbelly is from the island of Barbados in the Caribbean (Figure 18-9). The breed likely originated from crosses of African hair sheep with wool sheep brought from Europe. The Barbados Blackbelly sheep have a medium to thick hair coat which sheds in the spring. The coat can be various shades, ranging from dark brown to light tan with black on the underbelly and black points on the nose, forehead, and inside the ears. Rams have a thick covering of hair on the neck which travels down to the brisket and may extend



FIGURE 18-9

Barbados sheep have hair instead of the traditional wool covering. These sheep are popular in the Southwest United States.

to the shoulder. Barbados Blackbelly sheep have an average lambing rate that ranges from a 150–230 percent lamb crop. Barbados Blackbelly rams are polled (have no horns) and should not be confused with the horned American Blackbelly, a breed developed in the U.S. by crossbreeding the Barbados Blackbelly with horned breeds, including Rambouillet and Mouflon.

Barbados Blackbelly	
Origin	Barbados
Brought to U.S.	1904
Purpose	Meat

Dorper The Dorper is a South African meat breed developed in the 1930s (Figure 18-10). The breed was developed for the arid regions of South Africa and is one of the most fertile of sheep breeds. The Dorper has a short, light covering of hair and wool. The breed has a characteristic black head with a white body, although white-headed Dorpers are

FIGURE 18-10

Dorper sheep are a hair breed that can have either a black or white head.



Courtesy of Riverwood Farms, Eric Bruns

acceptable. This breed shows exceptional adaptability, hardiness, reproduction rates, and growth. The ewes are excellent mothers. The Dorper can thrive under range conditions where other breeds of sheep and other animals can barely exist.

Dorper	
Origin	South Africa
Brought to U.S.	1995
Purpose	Meat

Additional hair breeds are listed in Table 18-4.

TABLE 18-4

Hair Breeds

Carpet and Fur Breeds		
Breed	Purpose	Origin
Blackfaced Highland	Wool	Scotland
Karakul	Wool	Asia
Hair Breeds		
Breed	Purpose	Origin
American Blackbelly	Meat	U.S.
Katahdin	Meat	U.S.
Romanov	Meat	Russia
St. Croix	Meat	Virgin Islands

Overview of the Goat Industry

Goats were probably one of the first livestock animals to be domesticated. Early humans depended on goats for milk, meat, skin and hair for clothing, and other items. Today, goats are of major importance to the economy and food supply of many countries. More people worldwide drink goats' milk than cows' milk. While cows' milk and beef are more popular in the United States, the consumption of goat milk and meat is on the rise due to an increase in cultural diversity. Most goats in the U.S. are located in Texas, California, Georgia, Missouri, Wisconsin, and Indiana.

Industry Terminology: Goats

Female goat	= doe
Male goat (intact)	= buck
Castrated male goat	= wether
Young goat (male or female)	= kid



Courtesy of USDA

FIGURE 18-11

Chevon (goat meat) is consumed by many ethnic populations in the U.S., and is becoming an alternative low fat, red meat option for health-conscious American consumers.

chevon

goat meat; also known as cabrito

Introduction to Breeds of Goats

Goats are classified into three basic groups depending on their purpose. The three classifications are meat, dairy, and fiber. Some breeds are considered dual purpose and can function in more than one group of goats. Meat-type goats are goats that have a thicker, less refined body structure. Dairy goats are like their cattle counterparts, having a more refined body shape, putting the energy into producing milk rather than a heavier bone construction. Fiber goats are goats that are valued for the wool or hair they produce.

Meat Goats

Goat meat is also known as **chevon** or cabrito (Figure 18-11). Goat meat is very common in Africa, the Mideast, and in South America. Meat goats have



Delmar/Cengage Learning

FIGURE 18-12

Goat meat, especially Boer buck, is becoming popular in the United States.

become popular in the U.S. in the past three decades due to immigration of people from Latin American and Mideast countries to the United States. Goat production has also become popular because of the low cost, low maintenance, and low space requirements that meet the animals' needs as compared with cattle production. Goat meat is also valued for being low in fat content.

Boer Goats/Boer Crosses The Boer goat originated in South Africa in the early 1900s when farmers began selective breeding for a meat-type goat (Figure 18-12). Breeders selected for good conformation, rapid growth rate, high fertility, excellent carcass qualities, and short white hair with red markings around the head and shoulders. Boer goats were introduced into the United States in 1993. The number of Boer goats in the United States has increased rapidly. The Boer goat has meat production characteristics that are superior to those of any other breed of meat goat. The Boer goat is the most popular meat goat in the United States. Registered South African Boer goats are being crossed with other breeds, such as Spanish and Nubian goats, to increase their milk production. Most commercial meat goat herds consist of a Boer buck (male) and crossbred does (females).

Embryo transfer is becoming more common in the goat industry. Superior bucks and does are being used to produce embryos that are implanted into less expensive does. This technique allows for rapid improvement of genetics in the herd.

Boer Goat	
Origin	South Africa
Brought to U.S.	1993
Purpose	Meat

Kiko Goats Another popular breed of meat goat is the Kiko. The Kiko breed originated in New Zealand. Kiko goats are not as popular as the Boer goat and Boer hybrids. Kiko goats can be any color.



Courtesy of USDA Photo by Scott Bauer

FIGURE 18-13

Preferring woody and weedy species, goats select the young growing shoots first as they browse downward from the upper parts of a plant.

Kiko Goat	
Origin	New Zealand
Brought to U.S.	About 1990
Purpose	Meat

Savanna Goats The Savanna meat goat is a relatively new breed to the United States. The Savanna is similar to the Boer in that they have similar conformation and both breeds originated in South Africa. Savanna goats are all white in color. The number of Savanna goats in the United States is small but increasing with the popularity of meat goat production.

Spanish Goats The Spanish goat is a descendant of the milk goat breeds brought to the United States by Spanish explorers in the 1500s (Figure 18-13). It is sometimes called a brush goat because it can live on brush and weeds. Spanish goats are predominantly used for meat. They are prolific, adaptable, and can survive with little care.

Spanish Goat	
Origin	Spain
Brought to U.S.	1500's
Purpose	Meat

Dairy Goats

Goat milk is a high-calorie, high-fat milk that can be made into yogurt, butter, and cheese. The dairy goat produces more milk, pound for pound, than a dairy cow. The anatomy of the dairy goat can be compared to the anatomy of a dairy cow in that their major purpose is the production of milk instead of meat. Goat milk is higher than cow milk in milk-to-fat ratios, which makes the milk more fattening. In recent years, there has been an increase in Grade A goat dairies in the United States.

FIGURE 18-14

LaManchas are the only truly American breed of dairy goat. Their distinguishing characteristic is that they appear to have no ears.



Courtesy of Shannon R. Lawrence

There are several breeds of dairy goats, ranging from the small Nigerian Dwarf dairy goat to the very large Saanen. The medium- to large-size breeds include the Toggenburg, Nubian, Oberhasli, LaMancha, and Alpine.

Most dairy goats are polyestrous, or will breed numerous times per season. The breeding season is from September to March. Does are usually bred to kid in early spring. Many producers breed does at 15 to 18 months of age.

did you know?

One of the breed characteristics of the LaMancha dairy goat is that they appear to have “no ears” (Figure 18-14). They have what are called gopher ears. This characteristic is favored by LaMancha breeders because the goats can easily be identified from other dairy goats, so the trait is purposely bred.

Saanen The Saanen originated in Switzerland and is the largest of the dairy goat breeds (Figure 18-15). The Saanen breed produces more

FIGURE 18-15

Saanen dairy goats are the largest of the dairy breeds, and produce the most milk of any breed.



milk than any other breed. Goats of Swiss origin are known for being the most prolific milk-producing dairy goats. This breed was first imported into the United States around 1904. The color of this breed is white or light cream, with white being preferable. Saanens are, as a rule, very calm and mild-mannered.

Saanen	
Origin	Switzerland
Brought to U.S.	1904
Purpose	Milk

French Alpine The French Alpine breed originated in France from Swiss foundation stock (Figure 18-16). It was first imported into the United States around 1922. The breed ranges in color from pure white to black, with many other varied color patterns. The Alpine is a medium-sized dairy goat breed.

French Alpine	
Origin	France
Brought to U.S.	1922
Purpose	Milk

FIGURE 18-16

Alpine dairy goats originated in the Swiss Alps.



Courtesy of Sutton Farms and Amy's Pride

dual-purpose

more than one purpose; an animal that produces more than one product



Courtesy of Latimer Luck Acres

FIGURE 18-17

A Nubian goat. Notice the trademark long ears.

Nubian The Nubian breed originated in Africa. The breed was developed in England by crossing African bucks with British dairy breeds. It was first imported into the United States about 1896. Nubians may be any color or combination of colors. They have short hair, long, pendulous ears, and a Roman nose (Figure 18-17). The Nubian is not a heavy milk producer, but its milk has a high average butterfat content. Their breeding season is much longer than that of the Swiss breeds, so it is possible to produce milk all year long. This breed of goat is considered to be **dual-purpose**, providing both milk and meat. Nubians are also known for their distinctive bleat.

Nubian	
Origin	Africa—crossed with English dairy goat breeds
Brought to U.S.	1896
Purpose	Milk

Nigerian Dwarf Dairy Goats Nigerian Dwarf Dairy Goats originated in Africa, although refinement of the breed occurred in the United States

FIGURE 18-18

The Nigerian Dwarf dairy goat is the only true miniature dairy breed.



Courtesy of Shannon R. Lawrence

(Figure 18-18). Nigerians are the only true dwarf goat and come in all colors. Due to the small stature of the goat, it has become a favorite with small acreage farmers. Nigerian Dwarfs produce high-quality milk, and are also becoming a popular breed as pet goats. These goats are not seasonal breeders, which means they can be bred at any time during the year.

Nigerian Dwarf	
Origin	Africa
Brought to U.S.	Unknown
Purpose	Milk

mohair

the long, silky hair from the Angora goat

browse

the leaves, shoots, and twigs of shrubs, vines, and small trees

Fiber Goats

More than 75 percent of the fiber goat population in the United States is found in Texas, and 60 percent of the world production of mohair comes from Texas. Fiber goats produce mohair and meat, and help to control brush and weeds in range improvement programs (Figure 18-19). Fiber goats are best adapted to dry, mild climates, and prefer the browse found on rangeland.

FIGURE 18-19

Fiber goats such as these Angora goats are popular in the Southwest U.S.



Courtesy of Dr. Fred Spec

Purebred flocks are generally small and are reserved for breeding purposes. Commercial flocks are larger and concentrate on meat and mohair production. Some producers maintain flocks of wethers mainly for mohair production.

Angora The Angora goat is an ancient breed. It originated in the mountainous region of Turkey, which has a dry climate and great extremes in temperature. The Angora goat has been most popular in the southwestern United States. The fiber of the Angora goat is called mohair.

Angora	
Origin	Turkey
Brought to U.S.	1849
Purpose	Mohair fiber

Cashmere Goats Cashmere refers to the soft down or winter undercoat of fiber produced by most breeds of goats, except the Angora. There is no true genetic breed of cashmere goats, but through selective breeding, a cashmere-producing type of

goat has been developed. Some breeders in the United States have imported goats from Australia and New Zealand to breed with native stock and to improve the cashmere-producing ability of the goats. The production of cashmere fiber from goats is a small and relatively new industry in the United States. The world demand for cashmere normally exceeds the supply. If the fiber is not harvested after growth stops, it will be shed naturally.

Cashmere	
Origin	Unknown
Brought to U.S.	1980's
Purpose	Cashmere fiber

Summary

The total number of sheep in the United States has decreased over the past several years while the number of goats, especially meat goats, has increased. Goats and sheep are two of the oldest domesticated animals. They are similar in many ways. Sheep and goat production is a small but important part of U.S. livestock production. Sheep are classified according to their production possibilities, either for meat or fiber. Sheep are produced for three commodities: production of fine wool for high-quality clothing, production of long wool for upholstery and rugs, and production of meat. The fine wool breeds, such as the Merino and Rambouillet, are used for fiber production. Medium wool breeds, such as the Suffolk, Hampshire, and Dorset, are used primarily for meat production. Long wool breeds, such as the Lincoln and Romney, are valued for the long staple of their wool used for carpets and fabric. These breeds are also common in crossbreeding programs. Crossbred sheep are used mainly for meat production. The hair sheep breeds, including the Barbados Blackbelly and Dorper, are covered in a light layer of hair that naturally sheds. These sheep are common in warmer climates like the Caribbean. Though not common, sheep may also be used for milk production.

The goat industry has increased in recent years in the U.S., due in part to the influx of people from diverse cultures. Goat production has also become popular because of the low cost, low maintenance, and low space requirements compared with beef cow production. Goats are defined by their purpose: fiber, meat, or dairy. However, there are also dual-purpose breeds that can be used for both milk and meat. Goat meat consumption is on the rise. More people worldwide drink goats' milk than cows' milk. Dairy goats produce more milk, pound for pound, than dairy cows. Goats produce fiber and meat, and help to control brush and weeds in range improvement programs. Angora goats produce mohair, and other fiber goats are also used for the cashmere fibers found underneath the outer layers of their coat. As a result, goats are a multi-functional, valuable production animal whose popularity will continue to increase as countries become more diverse.

Quick Facts

- Sheep are raised in every state in the United States.
- The total number of sheep in the United States is declining.
- Large commercial flocks produce the majority of lambs and wool in the United States.
- Sheep are commonly classified by their primary purpose – wool or meat.
- Wool-purpose sheep are classified by the type of fibers they produce.
- Sheep produce different types of fibers: fine, medium, long, and hair.
- Crossbred sheep are often bred for dual purposes.
- Goats were one of the first animals to be domesticated.
- The Saanen dairy goat is the largest dairy goat breed and produces the most milk.
- There are three divisions of goats: meat goats, dairy goats, and fiber goats.
- Meat goats, especially Boer goats, are becoming increasingly popular in the United States.
- Nubian goats are considered dual-purpose because they provide both meat and milk.

Student Learning Activities

1. Have students visit a dairy goat farm and interview the owner about dairy goats.
2. Have someone with goats come to the school and let the students handle the goats.
3. Name and describe other dairy goat breeds not listed.
4. Visit a sheep farm.
5. Visit a meat goat operation.

Discussion Questions

1. Explain the three basic classification groups of goats.
2. Explain the uses of sheep.
3. Explain the difference in range production and farm flock production.
4. What is a micron and how is this measurement used in wool production?
5. What is lanolin? Explain the significance of lanolin.

Review Questions

True/False

1. Sheep are raised in every state in the United States.
2. The U.S. is the number one producer of sheep products.
3. More people worldwide drink goat milk as opposed to cow milk.
4. Hair sheep were bred for warmer or tropical climates.
5. Boer goats are originally from South Africa.

Multiple Choice

1. One classification of sheep is by _____.
 - a. milk or meat
 - b. wool or meat
 - c. wool or milk
 - d. meat or minerals

2. The sheep breed that produces “golden fleece” is the _____.
 - a. Angora
 - b. Dorper
 - c. Rambouillet
 - d. Merino
3. Goat meat is also known as _____.
 - a. cabrito (chevon)
 - b. capon
 - c. veal
 - d. pastrami
4. This breed of goat is considered to be both a meat and dairy goat:
 - a. Alpine
 - b. Nubian
 - c. Boer
 - d. Spanish
5. Two of the most popular fiber breeds of goats are the Cashmere and the _____.
 - a. Boer
 - b. Angora
 - c. Nubian
 - d. Wire coat

Completion

1. Most dairy goats are _____ breeders.
2. The wool-purpose sheep are classified by the type of _____ they produce.
3. _____ instinct refers to the tendency of sheep to stay together in a flock.
4. Female goats are called _____.
5. More than _____ of the fiber goat population in the U.S. is found in _____.

Short Answer

1. List the dairy goat breeds and a special characteristic of each breed.
2. Why is the sheep industry in the U.S. declining? Which of these reasons do you think is the most prevalent?
3. Why is goat production growing in the United States?
4. Explain the importance of the grading system of lambs for harvest.
5. Define Browse. List the types of browse available in your area.



CHAPTER 19

Management of Sheep and Goats



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Outline a management system for sheep and goats.
- Describe the common diseases and parasites of sheep and goats.
- Describe the different production systems used by the sheep and goat industry.
- Outline a program to reduce loss from disease and parasites in sheep and goats.



KEY TERMS

textured feed
accelerated
lambing/
kidding

prolapsed uterus
wether

drenching

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Wether	Mouton Castré	Hammel	Montone Castrato	El Morueco Castrado
Buck	Mâle	Bock	Cervo	El Cabrón
Doe	Biche	Damhirschkuh	Femmina di cervo	La Cabra
Ewe	Brebis	Mutterschaf	Pecora	La Oveja
Ram	Bélier	Widder	Ariete	El Morueco
Mutton	Mouton	Hammel	Montone	La Carne de Cordero
Goat meat	La viande de chèvre	Ziegenfleisch	Carne di capra	La Carne de Cabra

Management of Sheep and Goats

Although sheep and goats are different species of livestock, the management practices for both of these species are very similar. It is easy to modify production practices and switch between sheep production and goat production.

Production Operations for Sheep and Goats

There are two broad categories of sheep and goat production—purebred and commercial.

Purebred producers supply breeding stock for commercial flocks and herds, for other purebred flocks/herds, and for show purposes. The major goal of the purebred producer is breed improvement.

Commercial producers maintain flocks/herds to produce meat, milk, and fiber. Sheep and goats are both used for meat, while goats are used more for milk, and sheep produce most of the fiber.

Feeding and Nutrition

Feeding and nutrition for the sheep or goat depend largely on the goals of the producer and the sex, physical development, climate, and activity level of

the animals. Nutritional requirements will be quite different for pregnant or lactating females compared with juvenile females or castrated males. For example, lactating dairy goats that are used to produce milk require the same ratios of nutrients that a dairy cow in production needs.

Digestion

Sheep and goats have a very different digestive system than humans. Sheep, goats, cattle, and deer are examples of a class of animals called ruminants. Ruminant animals eat and swallow rapidly. Later they regurgitate, or throw up, a wad of feed called cud and chew it again to assist with digestion.

After food is swallowed and passed down the esophagus, it is stored temporarily in the rumen and reticulum, where it is exposed to several types of “good” bacteria that help the animal digest the food. Often, an animal will be seen lying in a sunny spot chewing. It is not eating; instead, it is chewing its cud.

Grazing

Most producers of sheep and goats rely on pasture and other roughages as the main source of feed. This works very well for all but dairy animals that require a more nutritious diet. Sheep will graze a pasture and are content with grass (Figure 19-1A), but goats prefer to eat bushy, broad-leaved plants and vines or browse. Browse is vegetation such as twigs and young shoots (Figure 19-1B). Sheep and goat producers can rotate animals from one pasture to another to increase the amount of feed that is available from each pasture. Rotation also helps break the internal parasite life cycle. Pastures should be rotated every two to three weeks, depending on their type and quality. They should not be overstocked. The stocking rate depends on the kind and quality of pasture used.



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FIGURE 19-1

(A) Sheep will graze on a pasture. (B) Goats prefer to feed on browse.

did you know?

Goats do not eat tin cans – but they have that reputation. Goats have a habit of picking up and tasting any new object in their environment, such as a tin can, out of mere curiosity. However, they will eat paper, flowers, tree bark, landscape plants, etc.

Feed

Feed is the single largest cost associated with raising livestock. If adequate grazing is not available, a good, nutritionally sufficient supplemental feed must be provided. Goats and sheep require energy, protein, vitamins, minerals, fiber (bulk), and water. Deficiencies, excesses, and imbalances of vitamins and minerals can limit animal performance and lead to health problems. Fiber is necessary to maintain a healthy rumen environment and prevent digestive disturbances. Water is the cheapest feed ingredient, but often the most neglected. Water containers must be kept clean and free of excrement. Fresh water should be supplied daily.

To maintain body heat in the cold weather, more feed will be required. Animals must use some of their food intake to generate body heat. There are commercially available feeds that require little to no extra nutrients to be complete. Some producers prefer to mix their own feed. However, unless performed by an experienced individual, self-mixing is highly discouraged. A mix of several different grains and extra nutrients, or a mix of commercial feeds will make it much harder to ensure that the animal is getting the nutritional requirements it needs. The commercial rations come in a textured ration and a pelleted form. These rations have been specifically

textured feed

a ration composed of mixed grains where the ingredients vary in size and shape



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FIGURE 19-2

Sheep and goats should be provided with roughages such as hay, pasture grasses, and browse plants.

formulated for the needs of animals in a particular class or category. **Textured feeds** are a mixture of grains, usually more than two, where the ingredients vary in size and shape. Sometimes molasses is added, and the feed is referred to as sweet feed. The molasses makes the feed highly palatable for the animals. Pelleted rations include the same ingredients as the textured feeds but are formed into pellets using heat and high pressure. Pelleted rations have an advantage over textured rations in that goats and sheep, who are selective eaters, cannot sort the feed ingredients. They are forced to eat the whole pellet, and will receive all the nutrition from the components in the pellet.

Hay

High-quality hay should be used to supplement feed and pasture if needed (Figure 19-2). Goats and sheep require roughage and forage to supplement their diets, and for the health of their digestive system. The hay may be legume, grass, or a mixture of legume and grass.

Minerals and Vitamins

A good quality vitamin and mineral supplement should be made available to all animals. Do not feed sheep a goat mineral mix that includes copper. Like all farm animals, copper is a required mineral for sheep. However, the amount of copper in goat feed is toxic to sheep. Always read the ingredient label of the mineral mix to ensure that the correct minerals are chosen.

Additives

Some feeds are medicated, which means they contain pharmaceutical components. Additives may also be used to treat a variety of diseases or to control internal parasites. These feed ingredients should be used according to the manufacturer's label.

did you know?

Goats prefer:

- ◀ browse plants over pasture grasses.
- ◀ feeding on rough, steep, hilly land over level areas.
- ◀ grazing the top of grasses rather than grazing close to the ground.

accelerated lambing/kidding

a production system in which sheep and goats give birth more frequently than once per year.

Feed Intake

Feed intake should be dependent on the size, weight, age, and purpose of the sheep or goat. For example, with dairy goats, generally the more high quality feed they eat, the more milk they produce.

Breeding

When female goats and sheep are in heat, they will usually behave differently than normal. They may vocalize constantly, wag their tails, or squat and urinate in the presence of a male. There are several ways of impregnating a female, including natural breeding, hand breeding, and artificial insemination (AI).

Ewes and Does usually are bred at about 7–9 months old to lamb or kid at 12–14 months of age. The number of females that a male can breed depends on the age of the male. A general rule of thumb for producers is to keep 3 mature males for every 100 females in the breeding system. Pregnant females should be allowed plenty of exercise. One way to accomplish this is to feed them away from the barn, which forces the females to exercise. Females that are too fat or carrying more than one baby are more likely to develop pregnancy problems. They should be observed daily.

The gestation time for both sheep and goats is around 150 days or approximately 5 months. If possible, the females should not be disturbed while giving birth. However, the female should be watched carefully during this process, and if she is having difficulty, assistance should be provided. Pens used for giving birth must be clean, warm, and dry. Clean bedding should be provided. Clean pasture may also be used for lambing and kidding.

Accelerated lambing/kidding is a system that some producers use to encourage goats and lambs to give birth more frequently than once per year. Commonly, this results in three births in

two years. The major purpose of this system is to increase production and income without greatly increasing costs.

Parturition

Both sheep and goats routinely have multiple offspring per pregnancy (Figure 19-3). Directly following birth, the newborn should nurse. If the newborn is too weak to nurse, it must be assisted. It is important to check that the mother is giving milk. During cold weather, it may be necessary to use heat lamps to keep the newborns warm. The newborns must be dried after birth to avoid chilling. The newborn's navel should be disinfected with tincture of iodine shortly after it is born to help avoid infection. Some females do not claim their newborns, a problem that is less common with older females than with younger, first-time mothers. The female may accept the newborn if she is put into a head gate and the newborn is allowed to nurse. If the mother continues to reject her newborn, it should be fed with a bottle and nipple (Figure 19-4). An orphaned baby must receive colostrum milk soon after being born in order to survive. Colostrum milk is the first milk out of the mother after the birth of the baby; it contains vital nutrients and antibodies for



FIGURE 19-3

Sheep and goats often have multiple offspring.

FIGURE 19-4

If the mother rejects the lamb or kid, it will need to be bottle fed.



©iStock/Darren Wise

the newborn. It may be necessary to use colostrum milk from another female. Some producers freeze extra colostrum milk so that it is on hand when needed. Commercial colostrum milk replacements are on the market for use in feeding orphans.

Some smaller producers and backyard breeders prefer to bottle-raise offspring, removing them from their mothers soon after birth. This method of raising makes the lamb or kid more accustomed to human handling. Newborns can begin eating feed at about one to two weeks of age.

Culling

Culling is the process of removing inferior breeding animals from the herd. If a female is going to be culled, she should be removed after the offspring are weaned. Females with bad udders, in poor health, or those that did not raise an offspring. Females with lumps in the udder, prolapsed uteruses, or ruptured abdomens should also be culled. The condition referred to as **prolapsed uterus** occurs when the uterus protrudes from the vulva. Females that have difficulty in lambing may develop a prolapsed uterus. An animal with this condition may die if not treated. A veterinarian should be called to administer treatment.

prolapsed uterus

a condition in which the uterus protrudes from the vulva

General Health Recommendations

A good health program for sheep and goats involves more focus on prevention rather than treatment of diseases and parasites. Sheep and goats do not respond well to treatment. When they become ill, they frequently do not recover. Sick sheep and goats are difficult to identify. Once a sick animal is identified, it often dies before treatment because a diagnosis could not be made in time and the illness progressed too far.

A program for the prevention of health problems includes the following steps:

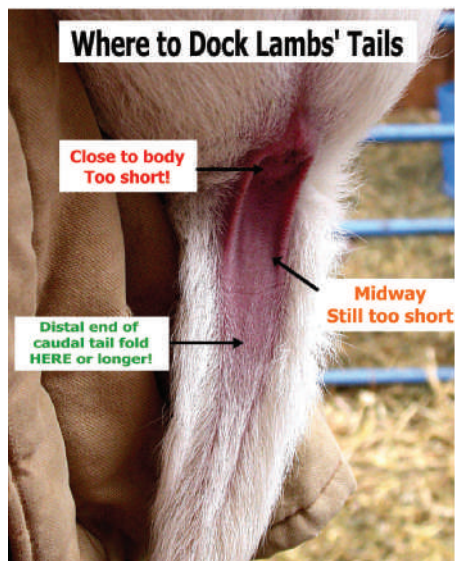
1. Watch the animals daily for signs of illness.
2. Use good feeding and management practices to prevent problems.
3. Handle animals with care; avoid stress whenever possible.
4. Treat all wounds with disinfectants.
5. Select only healthy animals for breeding purposes.
6. Isolate and watch newly purchased animals for at least 30 days before putting them with the rest of the animals.
7. Isolate sick animals for treatment.
8. Prevent diseases by vaccinating.
9. Control parasites with sprays, dips, dusts, and drenches.
10. Rotate pastures to prevent parasite buildups.

Castration

Castration is often performed on male animals that are not raised for breeding purposes. Castration is the removal of all or part of the male reproductive system and may be done with a knife, burdizzo, elasticator, “all-in-one,” emasculator, or can be handled by a veterinarian. Whichever method is used, sanitation

wether

a castrated male goat or sheep



Courtesy of Dr. Susan Schoenian, Western Maryland Research and Education Center

FIGURE 19-5

The American Veterinary Medical Association recommends that lambs be docked at the distal end of the caudal fold or longer to reduce the incidence of rectal prolapse.

procedures must be followed. After a male goat or sheep is castrated, it is referred to as a **wether**. Buck goat kids can become sexually active at about two to three months of age. Castration of these bucks usually takes place around two months of age.

Tail Docking

Lambs are routinely tail docked at the same time they are castrated. Tail docking is the removal of the longer part of the tail as shown in Figure 19-5. This is done to keep feces out of the wool and prevent it from becoming a health hazard. Ram lambs are usually castrated and tail docked between three and ten days of age.

Dehorning

Dehorning is usually performed at 3 to 5 days of age by burning the horn buds with a hot iron. This is usually the most cost-effective and practical method for the average farmer. Most producers of market lambs and dairy animals prefer to have the animals dehorned at an early age for safety reasons, while meat or market goat producers prefer to keep the horns on their animals.

Diseases

A number of diseases are common to sheep, goats, and cattle. While there may be some differences in symptoms, the general description of many of these diseases is very similar between species. These diseases include:

- ◀ Anthrax
- ◀ Johne's disease (pronounced "Yon-ees")
- ◀ Blackleg
- ◀ Leptospirosis
- ◀ Bloat
- ◀ Pinkeye
- ◀ Brucellosis
- ◀ White Muscle Disease

The following is a discussion of diseases that generally affect only sheep and/or goats.

Bluetongue (Sore Muzzle) Bluetongue is a disease of sheep that is caused by a virus. It occurs mainly in the western United States. It is spread from animal to animal by small gnats. Bluetongue weakens a sheep's resistance to other diseases. Death occurs in about five percent of a flock, and is usually due to secondary infections such as pneumonia.

Enterotoxemia (Overeating Disease) Enterotoxemia is a disease caused by a bacterium. It affects both sheep and goats, with lambs and kids being most affected. The bacterium is a normal inhabitant of the intestinal tract and is not a problem. Under certain conditions, however, it can grow excessively and produce lethal amounts of toxin. If an animal is having convulsions, death will follow quickly. There is no treatment after symptoms appear. Enterotoxemia can be controlled through good management, proper feeding, and vaccination.

Caprine Arthritis Encephalitis (CAE) Caprine Arthritis Encephalitis is an incurable contagious disease of goats to which there is no vaccine. CAE not only affects the joints of animals, but damages the lungs and affects the immune system, leaving the goat defenseless against common ailments. The only resource is prevention. Producers can have their herd tested for CAE, and if an animal is found positive, it must be quarantined from other animals. Much emphasis has been placed on testing and the certification of herds that are "CAE free." This disease only affects goats.

Foot Rot Foot rot is a disease caused by the presence of two different bacteria. Both types of bacteria must be present for the disease to develop. Foot rot affects both sheep and goats. It is not the same disease as the foot rot that occurs in cattle because it is caused by different bacteria. Foot rot is extremely contagious, and may affect the majority of

the animals in the flock when an outbreak occurs. It is more likely to occur when animals are on irrigated pastures, wet lowland pastures, or in areas with high rainfall. Symptoms include lameness, loosening of the hoof wall, and a foul smelling discharge. Controlling foot rot involves regular inspection of the animals' feet, proper trimming of hooves, and keeping animals out of wet areas.

Mastitis Mastitis, which affects both sheep and goats, is usually caused by bacteria but can be caused by injury to the udder. The udder becomes swollen, hard, and sore. The milk is thick and yellow with flakes or clots. Often, the lamb or kid cannot nurse. The udder must be milked by hand, and the milk must be dumped. Testing for this disease is available, and with diligent treatment, it is curable.

Pneumonia Pneumonia is an inflammation of the lungs that affects both sheep and goats. It is caused by a bacterial or viral infection. Exposure to cold, damp, drafty conditions may cause pneumonia. It sometimes occurs as a secondary infection with another disease. Parasites in the lungs can also cause pneumonia.

Scrapie Scrapie is a disease that affects the central nervous system of sheep and goats. There is no cure or vaccine for scrapie; it is always fatal. Scrapie has a long incubation period, typically two to five years. The disease generally affects older animals.

In the United States, the USDA's Animal and Plant Health Inspection Service (APHIS) has used a voluntary program since 1992 in an effort to bring scrapie under control. Participants certify that their animals originate from scrapie-free flocks or herds. This is a cooperative effort involving producers, veterinarians, state health officials, and APHIS. The USDA initiated the National Scrapie Eradication Program in 2001. The goal of the program is to eradicate scrapie in the U.S. in 10 years, and have the United States recognized worldwide as "scrapie-free" in 17 years.

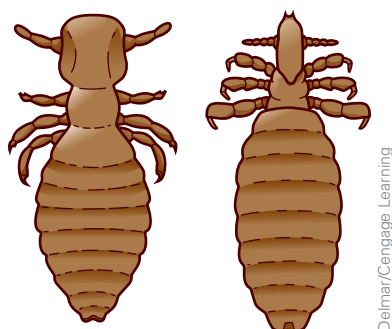
Sore Mouth Sore mouth affects sheep and goats, and is caused by a virus. It is more common in younger animals. Symptoms include blisters on the mouth, lips, and nose of the animal. Sore mouth is a zoonotic disease, meaning that it can be transmitted to humans.

Tetanus Tetanus affects sheep and goats, and is caused by bacteria. The bacteria live in the soil and enter the animal's body through open wounds. Symptoms include stiffness, walking with a straddling gait, inability to eat, and rigid jaw and tail. The animal has spasms of the voluntary muscles and then dies. There is no treatment after the symptoms appear.

External Parasites

Several external parasites attack sheep and/or goats. External parasites cause losses in the production of wool, mohair, meat, and milk. Sometimes they may cause the death of the animal. A combination of sanitation and the correct use of insecticides help to control most of the common external parasites of sheep and goats.

Lice Lice are tiny insects that live on animals (Figure 19-6). Several different kinds of lice attack sheep and goats. Some are bloodsucking; others are biting or chewing lice. They spread rapidly from one animal to another. Lice irritate the animal's body. Animals observed rubbing against things may be infested with lice. Control is achieved by dipping, spraying, or dusting.



Delmar/Cengage Learning

FIGURE 19-6

Two kinds of lice attack sheep: biting louse (left); sucking louse (right).

Mange and Scab Mites There are several species of mites that attack sheep and/or goats, causing a condition referred to as mange, scabies, or scab. Mites are tiny parasites that can hardly be seen with the naked eye. They burrow into the skin, causing irritation. Some cause scabs to form.

Blowflies Several species of blowflies attack sheep and goats. The screwworm, a maggot of one blowfly species, was a common pest of sheep and goats

in the southwestern United States. Screwworm flies lay their eggs in open wounds on the animal's body, and the eggs hatch into larvae that feed on the living flesh in the wound. One wound can contain hundreds of larvae. Tusk-like mandibles protrude from the screwworm larva's mouth. They hook into the flesh under the skin and can often cause death. However, an eradication program has been underway for many years, and the screwworm has been eliminated from the United States. There has not been a case of screwworms in the U.S. since 1982.



Science Connection

How did the United States eradicate the screwworm? An ingenious program utilized a technique called sterile male release. Sterile male screwworms were released into the wild in numbers so great that fertile males rarely got a chance to mate with females. As a result, the female flies laid only infertile eggs that did not hatch. During 1959, about two billion male screwworm flies sterilized by gamma irradiation were released during an 18-month period in an area of about 69,900 square miles in Florida. The screwworm was quickly eradicated from that state.

did you know?

Screwworm larvae have swollen ridges that encircle the entire length of the body, making them look like screws.

The USDA's Screwworm Eradication Program, ongoing from the 1930s to 2000, has eradicated the screwworm from the U.S., Mexico, and most of Central America. The screwworm still is found in South American and some Caribbean regions, where eradication work continues.

Wool maggots are caused by a species of blowfly. These do not grow in live flesh. Sprays are available for treating infested animals.



Science Connection

Mites belong to the Arachnida class which includes spiders and ticks. Mites have four pair of legs. There are burrowing mites that come from the *Sarcoptes* genus, and non-burrowing mites which come from the *Psoroptes* and *Chorioptes* genera.

Treatment Treatment for external parasites includes injections of the drug ivermectin, as well as a dose of ivermectin applied directly to the skin of the animal. This will also help with discomfort and will quickly kill the adult mites and lice.

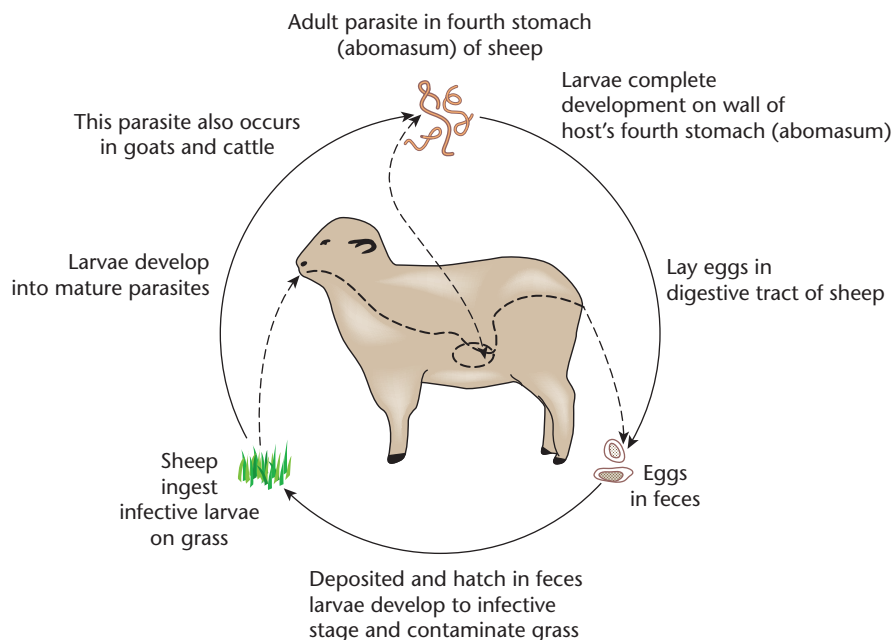
Internal Parasites

Internal parasites are the most serious health problem of sheep and goats. Both sheep and goats are particularly susceptible to internal parasites. Economic loss results from loss in weight, lower milk production, wasted feed, and lower breeding efficiency. Death losses from internal parasites are not high, but some animals do die.

Good management is the key to controlling losses from internal parasites. Overgrazing pastures, failure to rotate pastures, keeping unsanitary facilities, and improper feeding procedures are factors that contribute to problems with internal parasites. A regular program of internal parasite control should be followed.

Stomach and Intestinal Worms Worms found in the stomach and intestines of sheep and goats include: (1) common stomach worm, (2) thread-necked strongyle, (3) nodular worm, (4) hookworm, and (5) tapeworm. The life cycles of all of these worms are similar. The following general cycle is found in each type of worm. (1) In the intestines, the adult female deposits eggs that pass out of the animal in the manure. (2) The eggs hatch on the ground. The larvae crawl up on blades of grass, which the animal eats. (3) The larvae become adults inside the digestive tract of the animal. The cycle then begins again (Figure 19-7).

Female worms deposit several hundred to several thousand eggs per day. The common stomach worm is a bloodsucker. The other worms damage the wall of the intestine, making it more difficult for the animal to absorb nutrients. The common



Courtesy of the University of Illinois at Urbana-Champaign

FIGURE 19-7

The life cycle for a stomach worm is very similar to other types of worms that can afflict sheep and goats.

stomach worm is the most serious of all the internal parasites of sheep and goats. With enough worms, the animal may lose weight, quickly become anemic, and die.

Coccidia Coccidiosis is caused by the small protozoa called coccidia. These organisms normally live in the intestinal lining of the sheep or goat. This disease often affects young kids under stress, although it can affect older goats and sheep in overcrowded conditions. Bloody diarrhea is one of the symptoms of severe coccidiosis. The sheep or goat picks up the protozoa organisms from a contaminated environment. Coccidia can live undeterred in the ground for up to one year. Infected goats should be isolated from the rest of the herd. Many producers give their animals a medicated feed to help slow the spread or outbreak of coccidia. Each species of livestock is affected by its own type of coccidia. Death can occur if not treated.

drenching

oral administration of a liquid medication

Drenching is the oral administration of a liquid medication, generally for the control of internal parasites. A syringe or an automatic drenching

gun may be used to drench sheep or goats. The automatic drenching gun is more expensive, but saves time. It has a long, thin nozzle that can be put into the animal's mouth to administer the medication, and is more practical when large numbers need to be treated.

Nutritional Health Problems

Because sheep and goats are both ruminants like cattle, they are susceptible to some of the same nutritional ailments, such as bloat.

Urinary Calculi

Urinary calculi are small stones made out of minerals, called calculi, that form in the urinary tract. This disorder generally affects males on high-concentrate rations. The calculi block the urethra, causing retention of the urine. If the condition is not treated quickly, the bladder may rupture, causing death. If the bladder does not rupture, the animal may die of uremic poisoning. Wethers castrated at a young age have a much smaller urethra and blockage of the urethra can occur from smaller calculi.

The primary cause of urinary calculi is a low ratio of calcium to phosphorus in the diet. Other factors that increase the possibility of the condition are cold weather, reduced salt intake, and reduced water intake.

It is better to prevent urinary calculi than to try to treat it after it has occurred. If urinary calculi are diagnosed quickly, treatment can be effective. Surgery is required to treat the condition. A veterinarian should be called immediately if the condition is suspected. Recovery is less likely if the bladder ruptures.

**FIGURE 19-8**

Ear tags can be used for identification purposes.

Record Keeping

Record keeping helps the producer maintain important statistical information regarding his animals. Identification of individuals is necessary for a good system of record keeping. Ear tags designed especially for sheep and goats are commercially available for large producers (Figure 19-8). Backyard producers have an easier time identifying individuals due to the small number of animals. Birth and weaning weight records are necessary. For meat production programs, weights at marketing and carcass evaluations are important records. For dairy production programs, the amount of milk produced and the quality of milk produced are important points of information that should be included in records. Record keeping forms are available from agricultural extension specialists and universities.

When showing sheep at FFA or 4-H events, market lambs and market goats are required to have an ear tag before being shown in most junior shows. Other forms of identification, such as tattoos and microchips, are used for dairy goats.

Facilities and Equipment

Containment areas that include corrals and working chutes must be available for animals that are not used to being handled by humans. This equipment can help to reduce stress and prevent injury to both the animal and the producer. Specially sized equipment is available for sheep and goats.

Housing

Housing for sheep and goats does not have to be elaborate, but it must satisfy the health and comfort requirements of the animals, as well as facilitate

feeding and handling. There are five requirements of good housing:

- ◀ The building should be adequately ventilated but not drafty.
- ◀ The walls and ceiling should be free from condensation.
- ◀ The bedded area should be relatively dry and clean.
- ◀ The hay, grain, and water receptacles must be well-built and located so that feed and water are not wasted or contaminated.
- ◀ The facilities should provide easy access to the animals and require a minimum amount of labor.

Facilities should be planned with the future in mind, and should not become a limiting factor in the operation. Every barn should have access to fresh water for the health of the animals contained in the barn. Electricity can be useful for different purposes, but is not required. It is needed most for night lights and heat lamps that are used during kidding or lambing. Feeding equipment, either troughs or feed buckets, should be available. All feed containers should be clean and elevated off the ground or floor to prevent rodents from accessing them and to prevent contamination. Mineral and salt feeders are also needed. Water may be provided in troughs or with automatic drinking cups. For backyard producers, the use of individual housing units can be advantageous and gives each animal its own space. If group housing is used, make sure there is ample room for all animals inside shelters.

Every farm has different housing needs that depend on a variety of factors, including the number of predators, climate, pasture or range type, and the size of the flock or herd. If numerous lactating females are milked to produce other products such as cheese, butter, or soap, it is important to keep the milking area separate from the holding area of the other females. This is important for sanitation, as well as to prevent milk contamination.



©iStock/carnap72

FIGURE 19-9

Fencing is necessary for the protection of sheep and goats from predators.

Fencing

In most cases, sheep and goats should be fenced in (Figure 19-9). Fences that are five feet high are adequate to keep away most predators. Woven wire is the preferred fencing for containing animals and keeping out unwanted predators. Some producers use a combination of woven wire and electric fencing for additional protection.

Predator Loss

Losses from animal predators are a major problem for sheep and goat producers in the United States, accounting for almost 40 percent of the total sheep losses. Nationally, the most predominant animal predators are coyotes and dogs. Other animal predators include wolves, mountain lions, bears, foxes, eagles, and bobcats.

Practical and effective methods of controlling predators depend on the geographic location of the producer. The use of properly constructed fences and guard dogs are generally appropriate methods. In areas where fences are not commonly used, the use of guard animals such as llamas, donkeys, or dogs (Figure 19-10) on the pasture may prove to be



©iStock/Klaas Lingbeek-van Kranen

FIGURE 19-10

Dogs are sometimes used to protect and control sheep and goats.

effective. To control predators, small producers can construct secure housing so that sheep and goats are safe at night.



Science Connection

Did you know that a sheep can save your life if you are bitten by a snake? Antivenom is a serum that is typically derived from sheep. First, the sheep is injected with a small quantity of snake venom. Then, the sheep's body produces antibodies to defend against the toxic venom. Our body responds in the same way when we are bitten by a snake, except that the amount of antibodies produced may not be enough. The antibodies are collected from the blood of the sheep and manufactured into a concentrated antivenom to treat humans when they are bitten by a snake. Antivenom is injected into a human's vein or muscle. The serum neutralizes the venom, stopping further damage, but it can't reverse damage that has already been done. New kinds of antivenom derived from sheep are being studied because the traditional serum derived from horses is toxic to people who are allergic to horses.

Marketing

The marketing of both sheep and goats is fairly limited. Sheep, although they have been marketed successfully in the United States, are declining in popularity as a meat product and for wool production. Both meat and dairy goats are becoming more popular as a milk and meat source. Goats can provide both products in a much smaller space than cattle. As with any livestock, a private sale is usually a better option than going to an auction barn. At an auction barn, the seller must accept whatever price the animal brings, and the purchaser must accept the animal whether it is diseased or healthy. Animals are exposed to other animals in the auction barns, and possibly the diseases and parasites from many farms.

Summary

Management practices for sheep and goat production are similar. Within any good production program, producers pay close attention to several key production practices, which include lambing (sheep) and kidding (goats), castration, dehorning, culling, and record keeping. Also important are animal identification, protection from predators, adequate facilities and housing, nutrition, and health. Every farm has different housing needs that depend on a variety of factors, including the number of predators, climate, pasture or range type, and the size of the flock or herd. Feeding and nutrition for the sheep or goat depend largely on the goals of the producer, sex, physical development, climate, and activity level of the animals. A good health program for sheep and goats involves prevention rather than treatment of diseases and parasites. Some diseases common to sheep and goats are anthrax, bloat, pinkeye, blackleg, brucellosis, foot rot, pneumonia, tetanus, and internal and external parasites. Producers must consider many factors in the production and management of sheep and goats.

Quick Facts

- Sheep and goat production practices are similar.
- The gestation time for both sheep and goats is about 150 days or 5 months.
- Both sheep and goats commonly have multiple offspring per pregnancy.
- Castration is the removal of all or part of the male reproductive system.
- It is important to use an animal identification system, and to keep current health records for sheep and goats.
- Housing for sheep and goats does not have to be elaborate.
- Sheep and goats must have access to fresh, clean water.
- Sheep and goats are ruminant animals.
- Feed is the single largest cost of raising livestock.
- A good health program for sheep and goats involves prevention rather than treatment.
- There are a number of diseases that are common to goats, sheep, and cattle.
- Goats and sheep are especially vulnerable to internal parasites.

Student Learning Activities

1. Visit a working goat or sheep operation.
2. Visit a herd of meat goats, dairy goats, and sheep to observe the differences in management.
3. Make a collage of the different goat and sheep breeds.
4. Have the class talk to a veterinarian about the care of both goat and sheep herds. Discuss vaccinations, worming, hoof trimming, etc. with the class.
5. Explain how the information in this chapter would influence a supervised agricultural experience (SAE) project.

Discussion Questions

1. Why is the management of sheep and goats often discussed together?
2. How big of a part does nutrition play in management? Why?
3. What is accelerated kidding/lambing? Why is it important to some producers?
4. Explain the cud chewing behavior in sheep and goats.
5. Explain mastitis as it affects sheep and goats.

Review Questions

True/False

1. There should be 3 mature males for every 100 females in the breeding system.
2. The newborn's navel must be disinfected with astatine shortly after it is born.
3. Burning is the least cost-effective of all dehorning methods.
4. Guard animals such as llamas and donkeys may be used instead of fencing in some areas.
5. To provide the right amount of nutrients for the flock, producers should always mix feed themselves.

Multiple Choice

1. _____ milk is the first milk the mother produces.
 - a. Transitional
 - b. Colostrum
 - c. Mature
 - d. Pasteurized
2. The major goal of the purebred producer is:
 - a. meat production
 - b. fiber production
 - c. breed improvement
 - d. to produce animals for shows
3. Which of the following maladies is NOT a reason to cull a female?
 - a. Prolapsed uterus
 - b. Lumps in the udder
 - c. Poor health
 - d. Urinary calculi
4. Which of the following sheep would need the highest amount of nutrition?
 - a. A lactating female producing milk for a newborn
 - b. A castrated male raised for meat production
 - c. A ram during breeding season
 - d. A juvenile female that has yet to produce offspring
5. Which of the following is a factor that contributes to the risk of internal parasite infestations?
 - a. Rotating pastures
 - b. Reseeding pastures
 - c. Overgrazing pastures
 - d. Watering pastures

Completion

1. _____ is the process of removing inferior breeding animals from the herd.
2. After a male is castrated, it is referred to as a _____.
3. _____ is the preferred fencing for containing animals and keeping out unwanted predators.

4. _____ animals regurgitate a wad of feed called cud and chew it again.
5. High-quality _____ should be used to supplement feed and whatever pasture is available.

Short Answer

1. Describe three common practices used to prevent health problems in sheep and goats.
2. Why is it important for sheep and goat producers to maintain good record keeping practices?
3. What is the advantage of rotating pastures?
4. At what age are ewes usually bred?
5. What are the five requirements of good housing?



CHAPTER 20

Fitting and Showing Sheep and Goats



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe the basics for choosing a show animal.
- Explain the five major areas of emphasis in selection of a goat or sheep for show.
- Explain the types of sheep and goat projects.
- Describe the basics of fitting and showing sheep and goats.



KEY TERMS

structural
correctness
muscling
volume and
capacity

style and balance
growth potential
terminal show

muzzle
lamb tube

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Market	Marché	Markt	Mercato	El Mercado
Confidence	Confiance	Vertrauen	Fiducia	La Confianza
Disease	Maladie	Krankheit	Malattia	La Enfermedad
Nutrition	Nutrition	Ernährung	Nutrizione	La Nutrición
Wash	Laver	Waschen	Lavare	Lavar

Introduction to Fitting and Showing Sheep and Goats

This chapter will describe how to select, train, feed, and prepare an animal for the show ring. It is the exhibitor's responsibility to read the general and special rules governing the show he or she is attending. By sending in an entry form, the exhibitor is agreeing to abide by and uphold the rules of the show. Preparing an animal for the show ring requires commitment, hard work, and practice in advance to arrive at the show with an animal that is well-trained and groomed. Confidence is necessary to compete successfully, and good preparation and sufficient training time spent at home build that confidence.

Sheep and Goat Projects

First, a prospective exhibitor must decide what type of livestock he or she wants to show. This will most likely depend on (1) what animals are available, (2) what previous experience the exhibitor has, (3) what kind of facilities are available, (4) the availability of knowledgeable people in the area to help with the animal, (5) the money required to exhibit, and (6) how much time the exhibitor has to commit to the project before and after the show.



FIGURE 20-1

Feeding is only one responsibility associated with raising animals. Shown here are Kiko meat goats.

Raising a sheep or goat for show is a big responsibility (Figure 20-1). Animals must be cared for at least twice a day during all types of weather. Show animals require fresh water at all times, as well as careful feeding to ensure that the animal is the correct weight to be shown. It will also need regular exercise, training, grooming, and companionship. Sheep and goats prefer and enjoy companionship, so it is wise to raise and fit two animals for show or house the project animal where it will have a companion.

The prospective exhibitor should attend and observe a show of his or her chosen show animal. This is a great chance to see the care involved in raising a show animal, and to meet and talk to experienced exhibitors and producers. Most of these people are happy to share their thoughts and suggestions. Videos of shows are available online or may be available from the local agriculture teacher or extension agent.

The purpose of any animal show project is to:

- ▶ Experience the pride and responsibility of owning and caring for an animal.
- ▶ Learn how to feed, fit, show, and raise a show animal.
- ▶ Learn proper handling procedures to prevent injuries to the exhibitor and the project animal.

- ◀ Become a good citizen by working in groups and supporting project activities and events.
- ◀ Develop leadership initiative, self-confidence, sportsmanship, and other desirable character traits.

Selection of a Project Animal

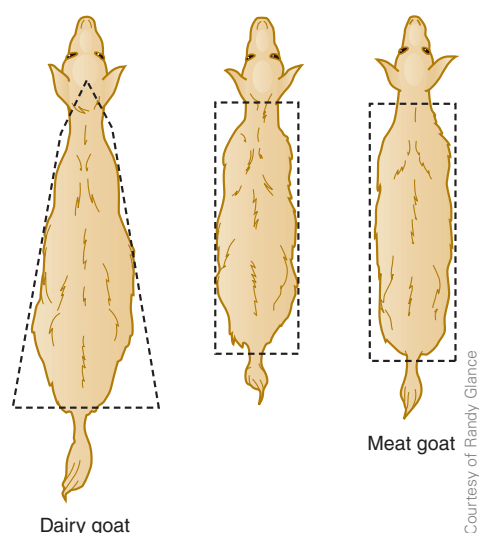
It is very important for the potential exhibitor to select an animal from a producer with a good reputation. Producers should be selected that have a reputation for high-quality animals that have been skillfully managed. Exhibitors should call and make an appointment with the producer before the visit (Figure 20-2). Most producers are very busy and greatly appreciate courtesy and cooperation. When visiting a prospective farm, exhibitors should be mindful of the animals, courteous, and respect the wishes of the producer. Exhibitors should not enter buildings or pens without permission. Most producers are happy to have exhibitors visit, and enjoy showing visitors their farms.

The flock/herd containing potential show animals should be examined for visible signs of disease; for example: runny eyes, runny noses, coughing, un-thriftiness. The health status may determine how well a project animal performs through the feeding

FIGURE 20-2

Students should make an appointment with a local producer to evaluate, select, and purchase a show animal.



**FIGURE 20-3**

Dairy goats have a triangular body shape, while meat goats have a more rectangular muscular shape.

period up to the show. Only animals that are free of disease and parasites and have been properly vaccinated should be chosen as project animals. Young animals are susceptible to many diseases. However, most diseases will not be a problem for healthy, vaccinated animals that are managed properly.

Once the exhibitor is satisfied with the health status and overall flock/herd performance, it is time to select a project animal. It is important for beginners to have a knowledgeable person assist them in animal selection. Some shows have specific age ranges for the project animals, and exhibitors should select an animal that falls within the appropriate age range. Most shows require that market sheep and goats have their milk teeth. Milk teeth are the baby teeth of the goat or sheep. Milk teeth are smaller and sharper than the permanent teeth. Usually sheep and goats shed their milk teeth at about 12 months of age. Selecting an animal is fun and exciting, but it can be a frustrating and difficult process. Each animal should be evaluated individually. When evaluating a prospective show animal, it is important to pay particular attention to structural correctness, muscling, capacity, and expression (Figure 20-3).

An unsound or structurally incorrect animal will probably become more unsound or more incorrect as it ages. It is impossible to find a perfect animal, but exhibitors should search for animals that come closest to the ideal.

Exhibitors should establish a budget for purchasing their animal and not exceed this amount. It is easy to be intimidated by someone who can pay a lot for a show animal, but without a firm commitment to exercise and feeding, no animal will perform well. Exhibitors should avoid the temptation to purchase a bottle baby. Bottle babies are the young of both sheep and goats that are not raised by their mothers. They are removed from their mothers for a variety of reasons. These reasons include the mother having too many babies to care for, illness, or an owner's personal preference to hand raise the animal. Baby animals may be cute and fun to bottle

structural correctness

the physical condition of the skeletal system or bone structure of an animal

muscling

the measure of the amount or degree of muscle an animal has

volume and capacity

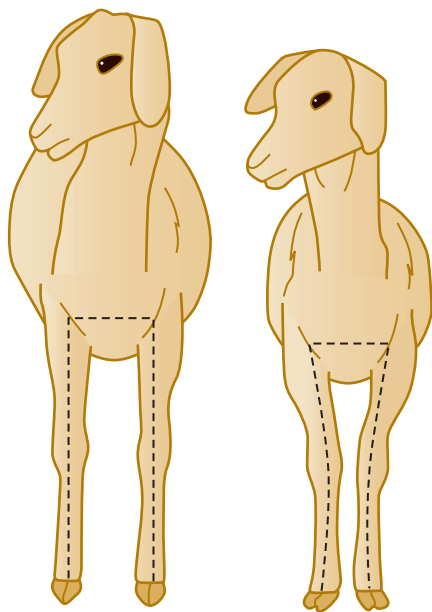
refers to the relationship between the length, depth, and width of an animal's body

style and balance

the way all the body parts of an animal blend together

growth potential

the ability of an animal to grow



Courtesy of Randy Glance

FIGURE 20-4

The goat on the left has the appropriate width to the front legs. This allows the body weight to be more evenly spread throughout the bones and joints.

feed, but properly raising an orphan is very labor-intensive and not economically feasible for market animals.

Make sure the selected animal meets age and quality standards. There are five major areas to consider. They are structural correctness, muscling, volume and capacity, style and balance, and growth potential.

- ◀ **Structural Correctness:** Structural correctness refers to the skeletal system or bone structure of an animal (Figure 20-4).
- ◀ **Muscling:** Generally, animals that walk and stand wide are going to be heavier muscled. Animals should have a deep, heavily muscled leg and rump, with the widest part of the leg being the stifle (knee) area, when viewed from behind.
- ◀ **Volume and Capacity:** Capacity is the amount of body volume and refers to the relationship between the length, depth and width of the body. The length and depth of the animal must be balanced with the width.
- ◀ **Style and Balance:** Style and balance refer to the way all the body parts blend together, how the shoulder blends into the rib cage, the rib cage to the loin, the loin to the rump, and how appealing an animal is to the eye.
- ◀ **Growth Potential:** The ability of an animal to grow rapidly is very important. Generally, the larger framed animals, as indicated by a long head, neck, cannon bone (lower leg bone), and body, will grow faster, be larger, and more competitive in the show ring.

Types of Sheep and Goat Projects

There are different kinds of sheep and goat projects available, including market lambs and market goats. Longer projects include dairy goats and breeding sheep and goats. Raising and showing breeding animals is similar to market animal projects. Fiber

classes for sheep and goats are included in some shows. These classes are for hair goats and wool sheep breeds.

Market Lambs

Junior market lamb shows are very popular. A market lamb project includes purchasing a young lamb after it has been weaned from its mother, usually at around eight weeks old. The exhibitor then has the responsibility of feeding and caring for the animal until it is ready to be marketed. An important advantage to this part of the industry is that an exhibitor can purchase a young lamb, feed, exhibit, and sell it in a matter of a few months. The shorter time period and lower investment makes this project appealing. Youth exhibitors may choose to show either a wether or a ewe in this class.

Market Goats

The junior market goat show has grown in popularity in recent years. This project animal is closely related to the market lamb project. The exhibitor is also responsible for the care of the animal from about eight weeks old until it is marketed. The market goat project is very good for younger or first-time competitors, as well as experienced competitors (Figure 20-5). The goats shown in this show are only meat goats, and

FIGURE 20-5

Good sportsmanship is an important characteristic for showing animals.



almost all the goats are either purebred Boer goats or Boer crosses. Youth exhibitors may choose to show either a wether or a doe in a junior market show.

Types of Shows

Depending on the project animal chosen and the exhibitor's individual goals, there are different types of shows for goats and sheep. Although market lambs and market goats are usually short-term projects, the ewes and does can be kept and shown for a number of years.

Exhibitors should always be aware of the rules of the particular show in which they are participating.

Terminal Shows

Market lambs and market goats are sometimes shown in **terminal shows**. After showing an animal at a terminal show, that animal is sold for harvest. Terminal shows usually have a carcass class. In the carcass class, judges look at the carcass of each animal and determine which animal has the best meat-to-fat ratio.

terminal show

after showing in this type of show,
the animal is sold for harvest

Purebred Shows – Sheep

Showing purebred or registered sheep requires a long-term commitment from the exhibitor. Purebred shows also require the registration papers that the exhibitor received for his or her lamb at the time of purchase. While some of these shows have a general lamb or mutton class, their first priority is the breed. Exhibitors should contact the National Breed Registry before exhibiting in a registered show to learn about all the rules for their particular breed.

Purebred Shows – Meat Goats

If an exhibitor has purchased a purebred or registered meat goat and would like to show that animal in registered shows, he or she should contact

the National Breed Registry for current trends in the show ring. There are classes for percentage purebred goats in registered goat shows. Percentage goats are goats that were mixed with another breed and are only a percentage of a purebred goat (i.e., 75 percent, 90 percent). Exhibitors should receive registry papers for an animal at the time of purchase.

Purebred Shows – Dairy Goats

Dairy goats are becoming more popular. With proper care, dairy goats can live from 10–15 years, and can produce milk for 7–9 years. Registered shows for dairy goats occur across the United States. There are breed-specific shows and shows that have classes for every breed. Shows have multiple classes for does and bucks, and some shows have wether classes.

muzzle

an item used to cover the mouth of an animal to prevent eating, biting, etc.



Courtesy of Amanda Stephens

FIGURE 20-6

Muzzles prevent show lambs from eating shavings.

Nutrition for Show Animals

Market animals must be fed properly to produce a good carcass with an adequate amount of lean meat and without too much fat. If a market animal is gaining too much weight (fat) without putting on muscle, the exhibitor must adjust the feeding and/or the exercise program.

Market animals have a tendency to eat the shavings in their pen, causing them to swell and feel fatter and more bloated to the judge. Exhibitors may use a **muzzle** at the show to keep the animal from eating the sawdust and shavings in the pen (Figure 20-6).

As with any animal, clean, fresh water must be constantly available to a market animal. If an animal is not drinking water, it is usually not eating properly. Exhibitors should check the water daily and clean it as necessary.

Long-term project animals do not have to be as muscular or have the same body type as market animals. As a result, the nutritional needs of long-term

project animals vary from the needs of market animals. For more specific instructions on nutrition, see Chapter 19.

Breaking and Training

Any show animal project requires the exhibitor to devote a lot of time and energy to develop a competitive show animal. Practice at home helps both the exhibitor and the show animal become accustomed to showing practices. Other than feeding and regular maintenance of the show animal, halter training, exercise, practice, and study are time issues that an exhibitor must take into consideration.

Time

Exhibitors must spend time with their project animals in order for the animal to become accustomed to human interaction and learn that its exhibitor means it no harm. Show preparation must begin months in advance, and the first step is to gain the animal's trust. Once the animal trusts its exhibitor, the exhibitor will be rewarded with friendship and cooperation from the animal. There is no replacement for hard work and time when training an animal.

Halter Training

Halter training should begin as soon as the animal is settled into its new home. It is best to use a halter at first, even if the exhibitor plans to show the animal without one (Figure 20-7). A halter should always be used away from home and, when at the show, outside of the show ring for the safety of the animal and others. The animal must be taught to lead and set-up properly in the show ring. Halter training is a great way to train a project animal for handling and give it valuable exercise that is needed for the animal to develop muscle definition.



Courtesy of Amanda Stephens

FIGURE 20-7

Lambs must be halter trained in order to protect the lamb and exhibitor.

Each time a sheep or goat is handled, exhibitors should touch the animal so that the sheep or goat becomes accustomed to human contact. Practice leading the animal by hand. The animal will quickly become accustomed to handling, and training the animal for showmanship will be easier.

Exercise

Another important component of any animal project is exercise. Animals shown as market animals are valued for their ability to produce meat. Meat is muscle, and exercise is necessary to produce muscle. It is important to develop a program that best fits the needs of the project animal and conforms to the limitations of the facilities in which the animal is raised. The main requirement for an exercise program is safety. Turn-out or exercise areas must be free of harmful edges and wires. The corners of the pen should be rounded, and the sides of the exercise pen should be solid to prevent the animal from trying to jump out and possibly hurt itself. It is most effective to exercise the animal intensely for a short amount of time (Figure 20-8). Exhibitors can also exercise their animals by leading. Multiple project animals can be exercised at one time if the animals are comfortable with each other.

FIGURE 20-8

Market lambs should be exercised regularly. This dog is trained to chase the lambs but not harm them.



Courtesy of Amanda Stephens

FIGURE 20-9

Practice is necessary for both the lamb and the exhibitor. This student is practicing bracing a lamb as he would in the show ring.



Delmar/Cengage Learning

Practice Showing

Exhibitors should practice showing their animal with someone acting as the judge (Figure 20-9). If at all possible, exhibitors should practice with different people to experience a variety of judging styles. With practice, an animal will quickly learn its assigned tasks and what is expected of it. The animal should be rewarded when it performs as expected, and then

returned to its pen. Overworking the animal, which will create bad habits and fatigue for both the exhibitor and the animal, should be avoided.

Study

An exhibitor should study the anatomy of their project animal, the history of the breed, and any other important information before going to the show. The judge will normally ask exhibitors questions about their project animals in the showmanship class.

Animal Care for the Show

In addition to time used practicing for the show ring, time should also be spent on preparing the sheep or goat for other aspects of showing. These include washing, clipping, hoof trimming, and routine care, such as keeping the animal free of diseases and parasites.

Washing and Rinsing

Project animals should be washed prior to shearing or clipping to remove most of the dirt and debris in the hair/wool (Figure 20-10). Washing will make it easier to clip/shear the animal. It also helps to prevent damage to clipper blades.



FIGURE 20-10

All show animals should be free of dirt and debris when entering the show ring.

The following steps should be used to prepare the show animal for washing.

- ▶ Project animals should be safely restrained while being bathed.
- ▶ The nozzle of the hose should not be too strong. Strong water pressure can cause the animal's skin to become sensitive or to bruise.
- ▶ Don't get water or soap in the animal's ears or eyes. This can cause a severe reaction and discomfort for the show animal. The exhibitor should use shampoo specifically designed for livestock.
- ▶ Use a cloth with water and mild soap to sponge the face and ears. Rinse the cloth and re-wipe the face and ears to remove any soap residue.
- ▶ When wetting the animal's body, make sure to start at the back of the head on the neck and work down the back from the top to the bottom.
- ▶ Apply shampoo evenly to all parts of the body, starting with the top. Exhibitors should use their hands when lathering the shampoo. The use of a soft brush is also acceptable. Using a brush too harshly can irritate or damage the skin of the show animal. Make sure to lather under the front legs and in the flank area.
- ▶ After a thorough rinsing, again, the exhibitor should use their hands or a soft brush to make sure that all shampoo residue is removed. Be sure to check any areas in which shampoo can accumulate, such as the flank and front leg areas.

Clipping or Shearing

Exhibitors should know the rules of clipping and shearing and follow them accordingly. Most modern judges prefer slick sheared lambs and goats (Figure 20-11).

FIGURE 20-11

Slick shearing is better for showing off the animal's conformation.



Courtesy of Ray Herren

The main reason for slick shearing/clipping is to emphasize the conformation of the animal. Preparing an animal for a show requires more than simply shearing or clipping the animal. These animals will be in the public eye and evaluated for market quality. For these reasons, it is important that animals are slick sheared and clipped uniformly without ridges, nicks, or cuts. A slick shorn animal should be covered afterwards to prevent sunburn and keep the animal clean.

Almost all shows require a show animal's hair to be clipped. This can be a daunting task if the exhibitor is new to showing. An experienced showman should be available to guide the exhibitor, help with proper usage of the clippers, and share clipping techniques. The following is an outline of rules and tips to follow when clipping the show animal.

- ◀ The animal should be safely restrained prior to clipping.
- ◀ The show animal should be clean and free of debris.
- ◀ Clippers and blades must be in good working order, and blades must be sharp. Dull blades can cause the clipped coat to be uneven and can even cause injury to the show animal.

FIGURE 20-12

Hoof care is important for the health of the animal. Hooves should be trimmed at least one week before the show.



Courtesy of Shannon Lawrence

- ▶ The person clipping the animal needs to be patient. There are several areas on the animal's body that can be cut by the clippers if care is not taken. For example the flanks, ears, lips, etc.
- ▶ After the first clipping or initial clipping, the second clipping should be done with a finer blade to smooth out any rough spots in the coat.

Hoof Care

The animal's hooves should be trimmed about one week prior to the show to allow the animal to heal if a hoof is accidentally cut too short and the animal becomes lame (Figure 20-12). Remember, the general public will be viewing each animal and developing opinions about the market industry—so all animals should be healthy and happy.

Disease and Insect Control

Animals should be vaccinated, dewormed, and free from any external parasites or diseases before going to the show (Figure 20-13). Healthy and disease-free animals make better show animals. Exhibitors must obtain a health certificate and up-to-date health records for their animal from a veterinarian prior to attending a show.



Courtesy of Amanda Stephens

FIGURE 20-13

Most vaccinations are administered by injection.

Show Preparation

After months of preparation, show day finally arrives. Having a plan to get the show animal and the exhibitor to the show with all the necessary items can help tremendously.

Packing for the Show

It is well worth the effort to make a list of the essential items needed for the animal and the exhibitor. Some items that may be included on the show list are:

- ◀ Bedding for the pen, if it is not provided
- ◀ Show book
- ◀ Extension cords
- ◀ Lamb tubes and blankets
- ◀ Muzzles
- ◀ Two sets of show clothing, in case one gets dirty
- ◀ Fan
- ◀ Feed pan
- ◀ Water bucket

- ▶ Grain and hay
- ▶ Halter
- ▶ Hose for washing, including nozzle
- ▶ Shampoo and coat preparations
- ▶ Pitchfork and broom
- ▶ Record book
- ▶ Chairs
- ▶ All grooming equipment (Figures 20-14A, B)
 - fitting stand
 - clippers
 - hoof trimmers
 - brushes
 - blower
 - wool cards for sheep
- ▶ Tools (hammer and nails)
- ▶ Wire, zip ties, and duct tape (all three can serve many practical uses)
- ▶ Health certificate and other necessary paperwork



Courtesy of Amanda Stephens

FIGURE 20-14A

Clipping stands or stanchions should be sturdy and adjustable to fit each animal.



Courtesy of Amanda Stephens

FIGURE 20-14B

Market lamb show equipment: shearing stand, feeding buckets, record book, halters, shampoo, shearers, drench gun, hoof trimmers, muzzle, and rubber boots.

Show Day

Exhibitors should remember to:

- ◀ Keep pens clean.
- ◀ Keep animals clean.
- ◀ Feed and water the animal regularly.
- ◀ Make sure the animal isn't too hot or too cold. Exhibitors should look for signs of heat stress like heavy breathing and panting, or signs that the animal is cold.
- ◀ Keep the area neat and tidy.
- ◀ Give themselves plenty of time to prepare for the show.

Stalls and Tie Outs

Exhibitors should arrive at the show as early as possible to give the animal time to become accustomed to its new environment. Some shows require exhibitors to provide their own bedding, but other shows will provide bedding in each pen. Animals should not be allowed to eat the bedding. Most pens at shows are small, and the animal will be spending a lot of time lying in the bedding. To keep shavings or straw out of the hair/fleece, a **lamb tube** or blanket will be helpful (Figure 20-15).

lamb tube

a textile body covering, sometimes made out of spandex, intended to keep animals clean before a show



FIGURE 20-15

After washing, lambs may be placed in a lamb tube or blanket to keep shavings and dirt out of the wool.

Courtesy of Amanda Stephens



Courtesy of Amanda Stephens

FIGURE 20-16

Show animals should be exercised at the show. Regular exercise is important for show animals.

If an animal will be exhibited for several days, an exercise schedule is important. Taking the animal for walks around the grounds is good exercise, and will help the animal to get comfortable and relaxed with the show's sights and sounds (Figure 20-16). Animals should be kept cool and hydrated, since exhibition season usually falls during some of the warmest times of the year. A fan placed in front of the animal's pen can help keep it cool if the weather is especially warm (Figure 20-17).

Feeding

Feeding an animal at the show will be a little different than at home. On show day, the animal should be fed at least two hours before show time and given half the amount of feed and water it is normally provided. This is done to keep the animal from looking fat, and to keep it alert and attentive.

Grooming

Animals should be well-groomed to remove dust and dirt from the coat before entering the show ring (Figure 20-18). It is important to remember to clean the hooves as well.



Courtesy of Amanda Stephens

FIGURE 20-17

Show animals should be kept cool during hot weather.

FIGURE 20-18

Animals should be well-groomed before entering the show ring.



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Exhibitor Preparation

Exhibitors should be courteous to everyone in the show ring, and always keep their project animal between themselves and the judge. Balancing courtesy and competitiveness is important to remember. Exhibitors should not only dress neatly; they also need to pay attention to the appropriateness of their dress. Remember, exhibitors will be bending over and squatting down at times, so they should wear clothes that are comfortable and appropriate. Exhibitors do not want to wear clothes that distract from their project animals. Some good rules of thumb concerning dress code are:

- 1) Leather boots or shoes for safety.
- 2) Clean jeans or slacks. No faded or ripped jeans.
- 3) Button-down shirts or polo shirts—conservatively buttoned up.
- 4) No hats.
- 5) No grooming equipment should be brought into the show ring, for safety reasons (i.e., wool cards in back pockets).

In the Ring

Exhibitors should remember that this is a livestock show, and not a beauty show for themselves. The animal is the one on display, not the exhibitor. Exhibitors

should refrain from talking except to the judge, if it is appropriate. Exhibitors should not roughly handle their animal, as this shows that the animal has not adequately been prepared for the ring.

Showmanship

Most shows include conformation classes, which are separated by weight. They also include showmanship classes, which are separated by the age of exhibitors who are showing the animals (Figure 20-19).

Showmanship is the true test of an exhibitor's knowledge of his or her project. Good showmanship can either make or break an animal in a competition. As much as 60 to 70 percent of the placing of the class is based on how well the exhibitor shows his or her animal. The purpose of showmanship is not to showcase the exhibitor, but to showcase the animal to its best ability. A good showman can evaluate his or her animal to determine its weaknesses. Once the weaknesses and strengths are determined, the showman can decide the best way to deal with each.



Courtesy of Greg Gilman

FIGURE 20-19

Project animals should be trained to set up properly, quickly and remain still.

Presentation

In order to properly present an animal during its class at the show, some basic guidelines are important.

- ◀ While in the show ring, it is important to remember that the exhibitor must keep showing the animal until leaving the ring.
- ◀ Leave enough space between the animal and other exhibitors' animals.
- ◀ When setting the animal up to be judged, the animal should be comfortable, cooperative, and should not fight the exhibitor.
- ◀ Always keep an eye on the judge (Figure 20-20). This is very important in order to keep track of what is going on in the ring. The judge will be moving around to get a better view of the animals.
- ◀ The exhibitor must know where the judge is at all times in order to be in the correct position. The animal should always be between the showman and the judge. This ensures that the judge always has the best view of the animal.
- ◀ The exhibitor should smile.
- ◀ When the animal is being viewed from the side or rear, the exhibitor should stand parallel to or slightly forward of the animal's head,



FIGURE 20-20

Exhibitors must be attentive to the judge, focused, and aware of their surroundings.



Courtesy of Amanda Stephens

FIGURE 20-21

Competitors should have control of their animal at all times.

about an arm's length away from the animal. When the judge switches sides, the exhibitor should move around the front of the animal to the correct position.

- ▶ When the judge is standing in front of the animal, the showman must stand far enough away from the animal so that the judge's view is not obstructed.
- ▶ Keep movements slow and controlled (Figure 20-21). An animal can sense tension and stress. Therefore, if the showman is upset, the animal will react in the same manner. This causes a lot of frustration that can be avoided by remaining calm.

Judging

If possible, the animal's front legs should be set slightly uphill from the back legs. The animal's back should be straight. This will help show off body



FIGURE 20-22

The judge will usually put his or her hands on the exhibitor's animal to determine the quality of the show animal.

conformation and muscling. The animal should be trained to stand still when the judge handles it (Figure 20-22).

The judge may ask questions of the exhibitor in the show ring. Some questions the exhibitor should be prepared to answer include:

1. How old is your animal?
2. What vaccinations does your animal need?
3. What part (judge points to a specific part of your animal) is this?

Summary

Raising a project animal for show requires patience, time, and responsibility. Before deciding to raise a project animal, it is important to evaluate the cost and time commitment that an animal project requires.

Once a prospective exhibitor has decided to pursue an animal project, it is important to purchase an animal from a trusted, respectable producer.

Prospective exhibitors should evaluate possible animals based on five major areas: structural correctness, muscling, volume and capacity, style and balance, and growth potential. The animal that comes closest to the ideal should be chosen.

There are several types of sheep and goat projects, including market lambs and market goats. These animals can be shown in either a terminal show or a purebred show. Animals that are shown in terminal shows are harvested after the show. Animals shown in purebred shows are not usually harvested.

In order to sufficiently prepare for a sheep or goat show, it is important to focus on several key aspects of raising a show animal.

1. Nutrition is important in show animals. They must be fed properly to produce a good carcass with the proper ratio of lean (meat) to fat.
2. Training an animal takes time and patience. An animal must be comfortable with and attentive to its handler for a successful show experience.
3. Exercising the animal is important. All show animals, especially market animals, need adequate amounts of exercise to produce the ideal amount of muscle mass.
4. Practicing with the animal for the show ring is important for both the exhibitor and animal. It is always a good idea to practice showing until the exhibitor and animal are completely comfortable, and the animal is responding correctly.
5. Studying the animal's anatomy and physiology will pay off at the show. Judges will typically ask exhibitors a series of questions related to their project animal. Judges take exhibitors' answers into consideration when awarding placements.

An animal should be washed, rinsed, and sheared before a show for the best possible appearance. Its hooves should also be clipped. The animal should be vaccinated and dewormed. Exhibitors should organize and bring all necessary supplies to the show.

There are two types of show classes: conformation and showmanship. Conformation classes evaluate the animal based on its physical characteristics. Showmanship classes evaluate the animal based on its performance in the show ring. Exhibitors should remember to be courteous to the other contestants and always dress their best for the judges. Show day can incite nervousness and anxiety, but if exhibitors are adequately prepared, shows can be a fun and rewarding experience.

In Perspective

My Show Lamb Project

by Amanda Stephens



Delmar/Cengage Learning

FIGURE 20-23

Amanda Stephens, high school lamb show participant.

Raising and showing livestock is more than a fun project. When I began showing lambs during my sophomore year of high school, I intended to have fun and meet new people. I had no idea that my livestock project would become much more.

Many family members have been involved in this project. My sister has now taken control of the project that I started with, and is also helping others with their project lambs. Because of the valuable knowledge I have learned showing livestock, biology class doesn't seem quite so hard.

Through the process of raising lambs from birth and training them to show, I learned work ethic, responsibility, and general knowledge about life. These valuable skills have been applied to every aspect of my life. Some things I learned while showing lambs include the following:

- **Self-confidence:** I learned to be comfortable in front of an audience. I learned to establish goals and set a course to achieve them. I also learned to believe in myself.
- **Public speaking skills:** I learned to speak clearly and confidently to the judge and audience.
- **Work ethic:** I learned to work diligently and efficiently with my lambs at shows and during practice times.
- **Responsibility:** I learned that animals must be fed and attended to regularly. I became responsible for their safety and protected them against predators such as wild dogs.
- **Good sportsmanship:** One of the most important things I learned was to have a good attitude even when I did not perform well.
- **Anatomy and physiology:** While working with my animal, I learned the basics of nutrition, the parts and operation of the digestive system, and anatomy and physiology that applied to humans as well as

other animals. This was a great benefit when I attended my science classes.

- **Time management skills:** I learned to balance my time between working with my lambs, schoolwork, my job, and FFA leadership activities.
- **Honesty:** I learned to follow show guidelines and compete fairly.
- **Social skills:** While competing at lamb shows, I learned to interact with many different people from all over the state.

- **Problem solving skills:** I learned to solve problems with my show lambs such as fencing breaches and health concerns.

- **Patience:** Show animals will not always cooperate. I learned to have patience, no matter how stressful the situation was.

Showing livestock is not just about winning. It is about learning life skills, improving academics, meeting new people, and growing as a person.

Quick Facts

- Exhibitors should always read the rules governing a particular show prior to attending that show.
- Raising a project animal is a big responsibility.
- Exhibitors should attend a show of the project animal they wish to show before committing to a project.
- Project animals should be selected from a reputable producer.
- Project animals should not be selected based on breed alone.
- There are five major areas of emphasis when choosing a show animal: structural correctness, muscling, volume and capacity, style and balance, and growth potential.
- There are several types of shows, including terminal shows and purebred shows.
- Exhibitors must obtain a health certificate for their animal prior to attending a show.
- Sheep and goats are sheared or clipped for show to place emphasis on conformation.
- Exhibitors should dress appropriately for the show ring.
- Good sportsmanship is essential.

Student Learning Activities

1. Visit a local sheep or goat farm. Have students write five questions to ask the producer.
2. Invite older students that show lambs or goats into the classroom. Have these students explain their projects.
3. Attend a local show where students and/or producers are showing lambs or goats.
4. Have someone bring in animals for the students to clip.
5. Have students learn to trim the hooves of a lamb or goat.

Discussion Questions

1. What can exhibitors learn from a project animal?
2. Why is it important to exhibit good showmanship?
3. Discuss how exhibitors should dress in the show ring.
4. Describe a sheep or goat project that you would select and why?
5. What are the positive aspects of a market project versus a purebred project? What are the negative aspects?

Review Questions

True/False

1. Judges will never ask show exhibitors questions related to their project animal.
2. Always keep an eye on the judge.
3. Market classes are separated by weight.
4. Wear loud clothing that distracts from your project.
5. Before choosing your project animal, it is a good idea to talk to people in the industry.

Multiple Choice

1. _____ and _____ refer to the relationship of the length, depth, and width of body.
 - a. Wideness, tallness
 - b. Short, fat
 - c. Volume, capacity
 - d. Skinny, short
2. _____ and _____ refers to the way all body parts blend together.
 - a. Volume, capacity
 - b. Skinny, short
 - c. Wideness, tallness
 - d. Style, balance
3. _____ is the part of the project that helps to build muscle on the animal.
 - a. Exercise
 - b. Vaccines
 - c. Housing
 - d. Metal
4. Exhibitors must have an up-to-date _____ for the animal in order to be allowed on the show grounds.
 - a. birth certificate
 - b. health record
 - c. maintenance file
 - d. show ribbon
5. A lamb tube helps keep an animal _____.
 - a. sterile
 - b. vaccinated
 - c. hollow
 - d. clean

Completion

1. Project animals should be selected from a producer with _____ animals.
2. Most shows have an _____ limit for project animals.
3. _____ _____ refers to the skeletal system or bone structure of an animal.

4. Exhibitors should practice showing their animal with someone acting as the _____.
5. _____ shows are shows in which the animal is harvested.

Short Answer

1. Name the different types of shows available for project animals.
2. What types of questions may a judge ask an exhibitor in the show ring?
3. What are the five major areas that should be considered before an exhibitor selects a show animal?
4. What rules should be followed when clipping the show animal?
5. List five items necessary to pack for show day.



Section 7

HORSES

CHAPTER 21 Introduction to Horses

CHAPTER 22 Management of Horses

CHAPTER 23 Training and Horsemanship

FFA AND 4-H CONNECTION



The following is a partial list of activities in which a student may participate using knowledge obtained in an equine program. Students should consult local and state youth organizations, such as FFA and 4-H, to determine opportunities in livestock-related programs available in their area.

- Agricultural Marketing
- Agricultural Sales
- Agriscience Fair
- Animal Nutrition
- Diversified Agricultural Production
- Horse Evaluation
- Horse Shows
- Livestock Evaluation
- Prepared Public Speaking

Proficiency Awards (FFA)

- Diversified Agricultural Production
- Equine Science
- Specialty Animal Production
- Veterinary Medicine





CHAPTER 21

Introduction to Horses



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe the characteristics of the horse industry.
- Describe the common breeds and types of horses.
- Describe the selection process in choosing a horse.



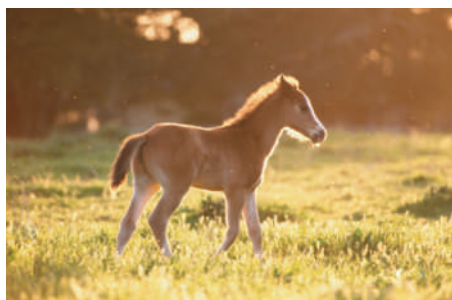
KEY TERMS

tack	warm-blooded	sterile
hand	tobiano	hinny
withers	overo	farrier
phenotype	tovero	grade horse
sclera	donkey	gelding
light horse	jack	unsoundness
hot-blooded	jennet	blemish
cold-blooded	mule	gait

LANGUAGE CONNECTION

English	French	German	Latin	Spanish
Equine	Équine	Pferdeartig	Equine	Caballar
Foal	Poulain	Fohlen		El Potro
Stallion	Étalon	Hengst	Admissarius	El Semental
Gelding	Cheval hongre	Wallach	Cantherius	El Capón
Horse	Cheval	Pferd	Equus	El Caballo
Mane	Crinière	Mähne	luba	El Crin
Mare	Jument	Stute	Equa	La Yegua

Horses and Ponies in the United States



S. Alden PhotoLink/Photodisc/Getty Images.

FIGURE 21-1

Some farms specialize in breeding services.

While many people own pleasure horses, commercial horse operations seek to make a profit. This chapter will cover commercial as well as pleasure horses. Breeding farms specialize in the production of offspring for sale, and also provide stallion services and other services for horses (Figure 21-1). Some farms specialize in training horses for show, racing, and pleasure. Boarding stables feed and house horses for people who own horses but do not have the facilities to properly care for them. Good management skills, a high level of capital investment, and well-trained workers are required for success in horse enterprises.

The three states with the most horses are Texas, California, and Tennessee, in descending order. There are approximately 9.2 million horses in the United States, providing more than \$102 billion to the U.S. economy. Over 4.6 million people are involved in the horse industry as owners, service providers, employees, and volunteers, with tens of millions more participating as spectators. This means that 1 out of every 65 Americans is involved with horses.

The most popular breeds of horses in the United States, based on purebred registrations, are the Quarter Horse, Thoroughbred, Paint, Appaloosa,

and Arabian. These breeds account for more than 75 percent of all horses registered with breed associations in the United States. The Quarter Horse is, by far, the most popular horse in numbers registered.

Color, face, and leg markings are often used to identify an individual horse. These markings are present at birth and do not change over the course of the horse's life. On many registration papers, the markings of a horse are recorded in order to identify the horse at a later time. The common face and leg markings are shown in Figure 21-2.

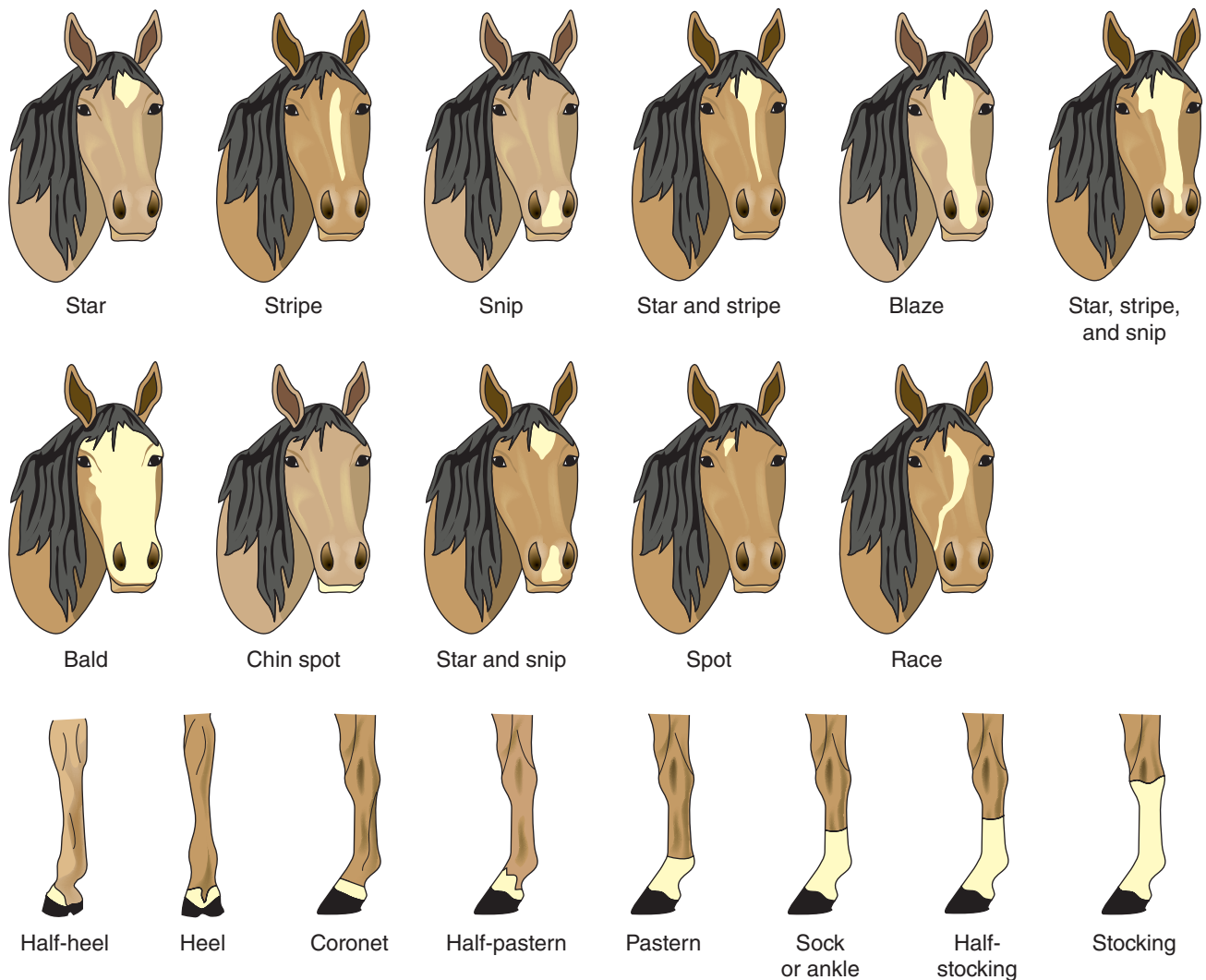


FIGURE 21-2

Face and leg markings.

tack

the riding equipment and accessories used with horses



Courtesy of Shannon Lawrence

FIGURE 21-3

Horse events draw many spectators throughout the country each year.

Horse racing is a major spectator sport, and horse shows and rodeos draw large numbers of participants and spectators each year (Figure 21-3). Horse **tack**, equipment, feed, and the production and sale of equine pharmaceuticals are major related industries.

Horses are beneficial in several ways. They contribute to the economic growth of the nation, and provide people with an opportunity for physical exercise. Owning and caring for a horse contributes to an individual's sense of responsibility. Horse-related events provide an opportunity for members of a family to participate in activities together.

Evolution of Horses

The equine of today are very different from their ancestors. About 58 million years ago, Eohippus (dawn horse) had four toes, lived in swamps, and was only about one foot tall. Horses are native to the North American continent, but Eohippus was long extinct before the emergence of humans. When Columbus arrived in the New World, there were no horses living on the continent. Columbus brought the modern horse to the New World from Spain.

Industry Terminology

Family	Equus
Group	Herd
Male – Mature over 4 years old	Stallion
Male – Under 4 years old	Colt
Male – Castrated	Gelding
Female – Mature over 4 years old	Mare
Female – Under 4 years old	Filly
Either sex – Under 1 year old	Foal
Either sex – 1 to 2 years old	Yearling

Breeds of Ponies

hand
a measuring standard (4 inches)
in the equine industry used to
describe the height of horses,
ponies, and other equines

withers
the highest part of the horse's back,
located at the base of the neck
where the top of the two shoulder
blades come together

phenotype
the physical characteristics of the
animal

Size is not the only physical distinction between horses and ponies. Ponies are smaller than horses, usually measuring less than 14.2 **hands** high. A hand is a unit of measurement of a horse's height, based on the width of a hand, which is 4 inches (10.16 cm). The height of the pony or horse is taken at the **withers**. The withers of the horse are the highest part of the horse's back, located at the base of the neck where the top of the two shoulder blades come together. Other differences in ponies and horses are **phenotype** and temperament. Ponies often exhibit thicker manes, tails, and coat. They also have proportionally shorter legs, wider bodies, heavier bone structure, shorter and thicker necks, and short heads with broad foreheads. There are about 65 individual breeds of ponies. Table 21-1 lists some of the more commonly known breeds. A few of the most popular ponies will be discussed here.



Math Connection

If you have a horse that is 15.2 hands high, the 15 equals the number of hands and the 2 is the extra inches. How tall, in inches, is a horse that is 15.2 hands? 16.2? 14.3? 17.1?

(15.2 hands = 62 inches; 16.2 hands = 66 inches; 14.3 hands = 59 inches; 17.1 hands = 69 inches)

TABLE 21-1

Common Pony Breeds

American Walking Pony	Chincoteague Pony
Connemara Pony	Hackney Pony
Haflinger Pony	Pony of the Americas (POA)
Shetland Pony	Welsh Pony
Dales	Fell
Dartmoor	Highland or Garron
New Forest	Norwegian Fjord

sclera
the outer layer of the eye that encircles the iris

Pony of the Americas

The Pony of the Americas, POA, originated in the United States and has appaloosa coloring on its coat. Other characteristics of a POA are mottled skin, also called parti-colored skin, as well as white sclera and striped hooves.

Pony of the Americas	
Origin	United States
Height	11.5–14 hands
Color	Appaloosa coat coloring, mottled skin (parti-colored skin)

Shetland Pony

The Shetland Pony originated in the Shetland Islands in Scotland (Figure 21-4). Shetland Ponies may have a variety of different coat colors. The Shetland Pony is registered in two size classifications: (1) less than 10.3 hands and (2) 10.3 to 11.1 hands. The Shetland Pony is used for pleasure riding by small children, showing, and timed events.

Shetland Pony	
Origin	Scotland
Height	Less than 10.3 and 10.3–11.1 hands
Color	Variable



FIGURE 21-4
Shetland Pony.

Courtesy of the American Shetland Pony Club

FIGURE 21-5

Welsh Pony.



Delmar/Cengage Learning

Welsh Pony

The Welsh Pony originated in Wales (Figure 21-5). The Welsh Pony is slightly larger than the Shetland Pony. Two size classifications are registered: (1) ponies less than 12.2 hands and (2) ponies between 12.2 and 14 hands. These ponies are also used for pleasure riding by children, showing, and timed events.

Welsh Pony	
Origin	Wales
Height	Less than 12.2 and 12.2-14 hands
Color	Black, gray, bay, roan, cream, chestnut



History Connection

In the early 18th century when the steam engine began to replace horses for work, there was a need to explain the power of an engine in relation to a horse. The term “horsepower” was coined to compare the output of a steam engine with the power of horses. This term is still used to measure the output of engines, turbines, electric motors, and other machinery.

FIGURE 21-6

Haflinger.



©Stockphoto/ambaradan

Haflinger Pony

Haflinger ponies have a long history. They originated from the alpine farms of Austria when a draft-type horse was crossbred with a pony. Their bodies are copper to a light golden color with a white mane and tail (Figure 21-6). They can be used for riding or driving and have no problem carrying adults. These “ponies” are an exception to the size rule, as they can mature to over 14.2 hands. Haflingers were used as a military horse during World War II.

Haflinger Pony	
Origin	Austria
Height	13.5–15 hands
Color	Copper to light golden with a white mane and tail

light horse

a horse used for riding, driving, and racing

Breeds of Light Horses

Light horses are used mainly for riding, driving, and racing. They measure 14 to 16 plus hands at the withers, and have a finer bone structure than draft horses. There are over 200 distinct breeds of light horses, each with a breed registry for purebred

TABLE 21-2

Common Breeds of Light Horses

Andalusian	Appaloosa
Arabian	Bashkir Curly
Cleveland Bay	Lippizan
Missouri Fox Trotting Horse	Morgan
Mustang	Paint Horse
Paso Fino	Quarter Horse
Saddlebred	Standardbred
Tennessee Walking Horse	Thoroughbred

animals. Light horses are the most numerous of all equine. The most popular breeds of light horses found in the United States are the Quarter Horse, Paint Horse, Thoroughbred, Arabian, and Appaloosa. Table 21-2 lists some common breeds of light horses.

Quarter Horse

The Quarter Horse originated in the United States (Figure 21-7). During the colonial era, horse racing was a common sport. Horses were bred to race fast for short distances. Colonial-era horse races were a quarter of a mile; the term *quarter miler*, later

**FIGURE 21-7**

American Quarter Horse.

Courtesy of the American Quarter Horse Journal

renamed the Quarter Horse, was used to describe the horses bred for these races. The Quarter Horse was widely used during the westward expansion of the nineteenth century and on western ranches. Quarter horses are known for their versatility in and out of the show ring.

Any solid colors are recognized by the American Quarter Horse Association. The only white on the horse should be on the face, and below the hocks and knees of the legs.

Quarter Horse	
Origin	United States
Height	Approximately 15 hands
Color	Any solid colors are recognized by the American Quarter Horse Association; white can only appear on the face and below the hocks and knees

Thoroughbred

Thoroughbreds are the main breed used in horse racing. The Thoroughbred originated in England. Development of the breed as a racehorse began in the 17th century. Thoroughbreds are tall, slim horses (Figure 21-8). Common colors are bay, brown, black, and chestnut, with roan and gray colors occurring occasionally. The Thoroughbred is considered to be a **hot-blooded** horse.

hot-blooded

an animal that is easily excited, spirited, bold, and a quick learner



Courtesy of the Illinois Racing News

FIGURE 21-8

Thoroughbred.



FIGURE 21-9
Warm-blooded horses are often used in dressage events.

cold-blooded
having a stable, calm temperament;
strong and rugged

warm-blooded
horses that exhibit the grace of the
hot-blood breeds and the strength
of the cold-blood breeds

did you know?

The rules of the Jockey Club state that a foal can't be registered unless it is the result of a stallion breeding naturally with a mare, with a natural gestation. The Jockey Club does not allow artificial insemination as a method to breed a mare. Other breed associations allow artificial insemination, which is widely used in the horse industry.

Hot-blooded horses tend to be easily excited, spirited, bold, and quick learners. They are bred for agility and speed, and tend to be physically refined, thin-skinned, slim, and long-legged. Thoroughbreds are registered with The Jockey Club.

Thoroughbred	
Origin	England
Height	Averages over 16 hands
Color	Bay, brown, black, and chestnut; occasionally roan or gray

Classifications Thoroughbreds (hot-blooded) are used in breeding programs with draft horses (**cold-blooded**) to produce **warm-blooded** breeds. Cold-blooded horses are known to have a stable, calm temperament. Horses belonging to the cold-blooded group are also known to be strong, rugged, durable, and have a much heavier skeletal system than the warm-blooded or hot-blooded breeds.

Warm-blooded horses have the grace of the hot bloods and the strength of the cold bloods. Breeding these two types of horses together produces a horse with heavier bones than thoroughbreds. Warm-blooded breeds are strong and sturdy, and are perfect competitors for dressage and jumping events (Figure 21-9).

American Paint

The American Paint originated in the United States from the descendants of horses brought to the Americas by the Spanish (Figure 21-10). The Paint horse became popular with the Plains Indians and the early American cowboys. The American Paint Horse Association recognizes numerous color combinations with an extra word of Overo, Tobiano, or Tovero to describe the “paint” pattern of the horse.

FIGURE 21-10

American Paint horse.

tobiano

paint horse color designation; head is marked in the same way as that of a solid-colored horse—solid, or with a blaze, strip, or star

overo

paint horse color designation; variably colored head markings

tovero

paint horse color designation; has dark pigmentation around the ears, which may expand to cover the forehead and/or eyes; one or both eyes are blue



Courtesy of the American Paint Horse Association

The **tobiano** head is marked in the same way as that of a solid-colored horse – solid, or with a blaze, strip, or star. There are round spots that extend along the neck and chest. The **overo** has variably colored head markings. The white does not cross the back between the withers and the tail. The **tovero** has dark pigmentation around the ears, which may expand to cover the forehead and/or eyes. One or both eyes are blue. The tovero is a combination of the tobiano and the overo.

American Paint	
Origin	United States
Height	Variable, but generally ranges from 14.2–16 hands
Color	Numerous color combinations; an extra word of either Overo, Tobiano, or Tovero describes the “paint” pattern of the horse

Appaloosa

The Appaloosa originated in the United States from the descendants of horses brought to the Americas by the Spanish (Figure 21-11). The color patterns of the Appaloosa are variable. There are five different patterns that appear within the Appaloosa breed. The hooves often have vertical black and white stripes. The Appaloosa has a visible white sclera (Figure 21-12).



Courtesy of the Appaloosa Horse Club, Inc.

FIGURE 21-11

Appaloosa.



©Stockphoto/Deborah Cheramie

FIGURE 21-12

Eye coloration in the Appaloosa.

The Nez Perce Indian tribe developed a selective breeding program using Appaloosas. Descendants of the Nez Perce horses were the foundation stock for the present Appaloosa breed.

Appaloosa	
Origin	United States
Height	14.2–16 hands
Color	Variable; five different patterns

Arabian

The Arabian horse originated in Arabia and is thought to be the oldest domesticated breed (Figure 21-13). It is small to medium in size and is hot-blooded. Colors are bay, gray, chestnut, white, or black. The Arabian has a reputation of intelligence, spirit, and stamina. This breed of horse is one of the most easily recognizable horse breeds. Most have a dish face and high tail carriage. The large lung capacity of Arabians helps to give them stamina.



History Connection

Arabians are one of the oldest breeds of domesticated horses, with archeological evidence dating back 4,500 years. Bedouin tribes of the Arab nation cherished this breed of horse. They were often housed indoors with their owners. Over the centuries, the Bedouin tribes of the Arab nations have zealously maintained the purity of the breed.

FIGURE 21-13

Arabian horse.



Courtesy of the Arabian Horse Association

Arabian	
Origin	Arabia
Height	14.2–15.2 hands
Color	Bay, gray, chestnut, white, or black

Draft Horses

Draft horses were once a major source of power on farms, but are used sparingly in modern agricultural operations (Figure 21-14). Draft horses are larger, heavier, and more muscular than ponies and the light horse breeds. They were selected and bred for their ability to pull heavy loads. Draft breeds include the Percheron, Shire, Belgian, and Clydesdale. Table 21-3 highlights some common draft breeds.

Probably the most famous of these breeds is the Clydesdale (Figure 21-15). The breed is most known for its appearance in advertisements and commercials by the Anheuser-Busch Company. A team of six matched Clydesdales were given to the owner of the Anheuser-Busch company during the Great Depression. Since that time, Clydesdales have become a symbol of the company.



Courtesy of the USDA

FIGURE 21-14
Historically, draft horses were used in farming operations.



Courtesy of Botts/Watson Photography

FIGURE 21-15
Clydesdales are among the most recognized draft horses.

TABLE 21-3
Breeds of Draft Horses

American Cream Draft	American Cream & White Draft
Belgian	Clydesdale
Friesian	Shire
Percheron	Suffolk

donkey

an animal that resembles a horse, only smaller in size with longer ears and an erect mane

jack

male donkey

jennet

female donkey; also referred to as a jenny

mule

a cross between a male donkey and a female horse

sterile

inability to reproduce

hinny

cross between a male horse and a female donkey



Courtesy of Bureau of Land Management

FIGURE 21-16

Donkey.

Donkeys, Mules, and Hinnies

A **donkey** is smaller than a horse and has longer ears and a short, erect mane (Figure 21-16). The male donkey is called a **jack**, and the female is called a **jennet** (pronounced jin-it) or a “jenny.” Donkeys are very sturdy animals and are very sure-footed on steep inclines. Donkeys also have a tough digestive system, and an astounding ability to get nutrients from near-inedible plants. Some donkeys are placed in pastures with young cattle, sheep, or goats to help protect the herd from dogs, coyotes, and other predators.

When a jack is crossbred with a female horse (mare), the resulting offspring is called a **mule** (Figure 21-17). Mules are **sterile**; that is, they cannot reproduce. Mules possess the strength and sure-footedness of donkeys and the vigor of horses. Mules come in all colors, but the most common colors are brown and black.

When a stallion (male horse) is crossed with a jennet, the resulting offspring is called a **hinny**. The hinny is smaller than a mule. They are sterile and not as popular as mules. Beyond size, hinnies are similar to mules.

Donkeys are also bred with draft horses to produce Mammoth Mules, which are about 17 hands high. Mules are used for performance, pleasure riding, and driving animals as well as for agricultural purposes (Figure 21-18).



©Stockphoto/Michael Klenetsky

FIGURE 21-17

Mule.

FIGURE 21-18

Mules are sometimes used in performance and pleasure riding.



Courtesy of Meredith Hodges and American Donkey and Mule Society, Lewisville, TX

Selection of Horses

A horse should be selected with care. Inexperienced or novice riders should always ask a more experienced horseman for help in finding a suitable horse. Veterinary records for the prospective horse should be made available for inspection. Horse ownership should not be taken lightly. Horses require a good deal of space, shelter, feed, veterinary care, **farrier** care, and sometimes require a trainer. A farrier is a person who specializes in the care of horse hooves. A veterinarian should examine horses considered for purchase.

farrier

a professional who cares for horse hooves

Cost of Ownership

The cost of horse ownership is high. A person should consider cost as well as other factors before purchasing a horse. Table 21-4 outlines some typical costs for horse owners.

Use of the Horse

The five general uses of horses are: (1) pleasure, (2) breeding, (3) working stock, (4) show, and (5) sport. Generally, one horse cannot be used in all of these ways. Horses should be selected for their

TABLE 21-4

Typical Per Year Costs of Horse Ownership

Feed Costs	\$775
Bedding	\$100
Horse Care Products	\$75
Farrier Service	\$600
Veterinary and Medicine	\$200
Boarding	\$3600 stall and pasture

Total costs = \$5350 annually. These costs are highly variable depending on the type and level of riding and competition, and the region of the country.

primary intended purpose. For instance, miniature horses can be used as service animals for the blind and disabled, while draft horses may be used for pulling wagons or for other heavy work.

Sources for Horses

Horses can be purchased from breeders, trainers, private owners, auctions, and dealers. The most reliable source for obtaining a horse is generally from a breeder or a trainer. Horses from these sources may be more expensive, but the quality of the animal can be certified. The breeder or trainer may provide assistance in selecting a horse, and provide additional assistance after the sale. Private owners may also be a good source of horses. Auctions are a less reliable source since it may be difficult to determine the soundness and quality of the horses offered.

Breed Selection

Certain breeds are better adapted for a particular use than others. Thus, the intended use of the horse may help to narrow the choice of breed. Personal preference is also a factor to consider when selecting a breed. A person who is not interested in breeding or extensive showing of horses may prefer to select a **grade horse**, or unregistered

grade horse

an unregistered horse that is not a purebred

horse. Grade horses often make excellent horses for pleasure riding. Grade horses can be less expensive than purebred horses. Purebred horses have a greater resale value and can be entered in purebred horse shows. The demand for a given breed should be considered if the owner's interest is in breeding and raising horses for sale.

Stallions are not recommended for the everyday rider. They are often hard to manage and control. For pleasure riding, a **gelding** (a castrated male horse) or mare is usually a better choice.

gelding

a castrated male horse

did you know?

The age of a horse can be estimated using its teeth. The size and angle of the teeth in the horse's mouth are a good indicator of age. As a horse becomes older, the angle of its teeth becomes slanted forward and outward (Figure 21-19). In older horses, the visible portion of the teeth is longer than in young horses.

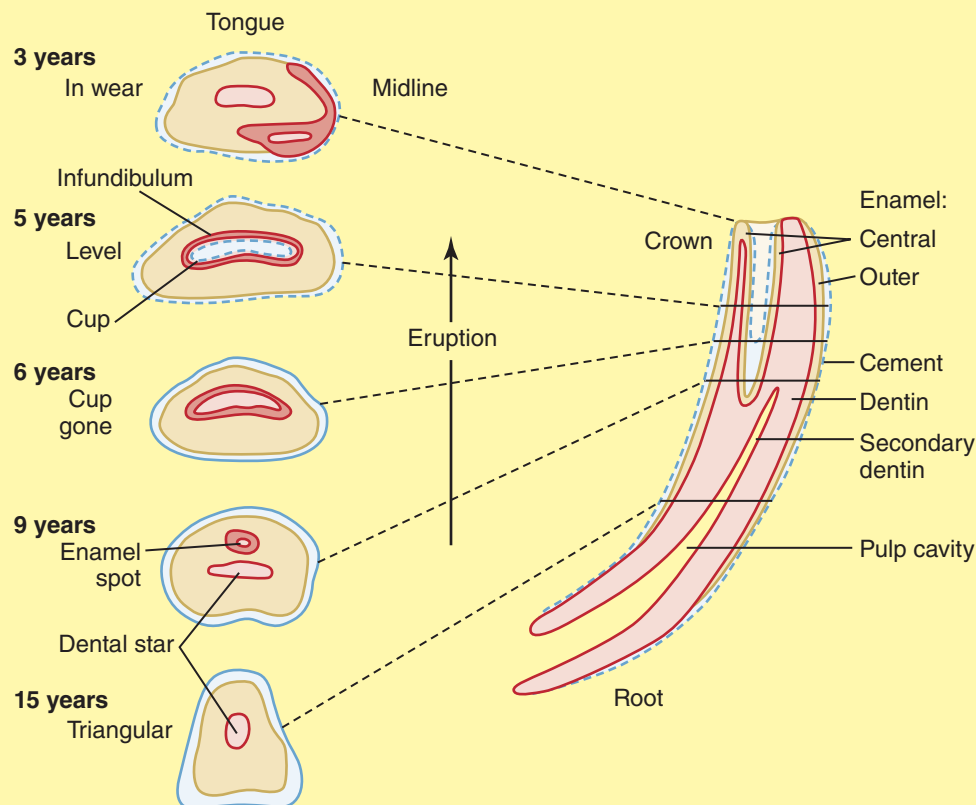


FIGURE 21-19

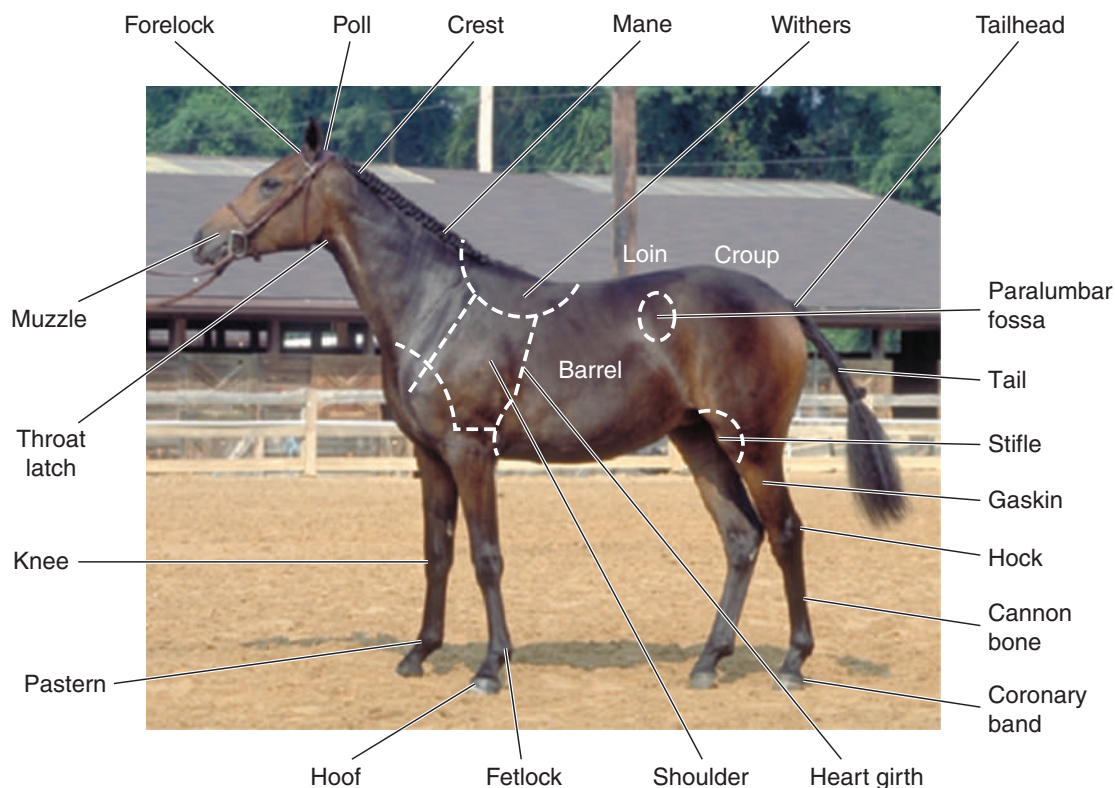
A horse's teeth can be used to estimate the animal's age.

Conformation

A person who is evaluating or judging a horse must know the parts of the horse. The parts of the horse are shown in Figure 21-20. The major points to consider when evaluating a purebred horse are given by each of the various breed associations. The breed association guide describes the physical traits that are desirable in that breed.

Feet and Legs Two of the most important parts of the horse are the feet and legs. As with most breeds of livestock, if the feet and legs are not sound, then the animal should not be purchased. The conformation of the legs influences the way the horse moves. Figures 21-21a and 21-21b show the correct and incorrect positions of the front legs of a horse. Figures 21-22a and 21-22b show the correct and incorrect positions of the rear legs of a horse.

The feet of the horse require special care. The hooves should be trimmed by a farrier, a craftsman

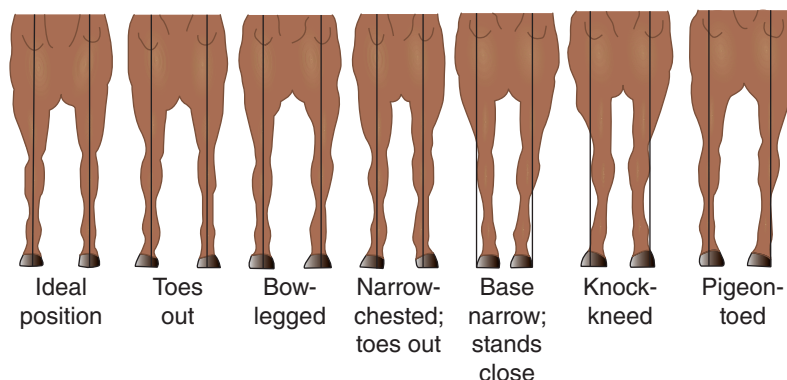


Courtesy of USDA/Bill Tarpenning

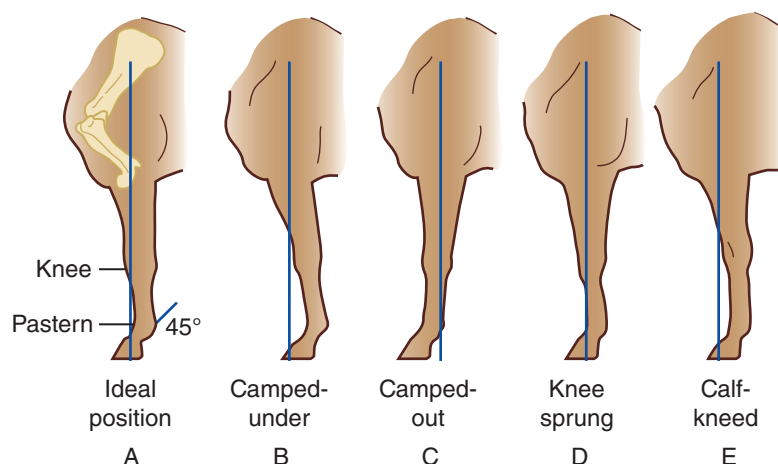
FIGURE 21-20

Anatomical parts of a horse.

(A) Vertical line from point of shoulder should fall in knee, cannon, pastern, and foot.



(B) Vertical line from shoulder should fall through elbow and center of foot.



Courtesy of the Appaloosa Horse Club, Inc.

FIGURE 21-21

Correct and incorrect positions of the front legs as shown from the front (A), and as shown from the side (B).

who cares for horses' feet by trimming and shoeing horses' hooves. Most horses require shoes to protect their hooves from injury and wear. The hooves must also be kept moist to avoid splitting and cracking. There are commercial preparations that will help with this problem when applied to the horse's hooves. The old adage "No foot, no horse" is true and should be kept in mind by horse owners.

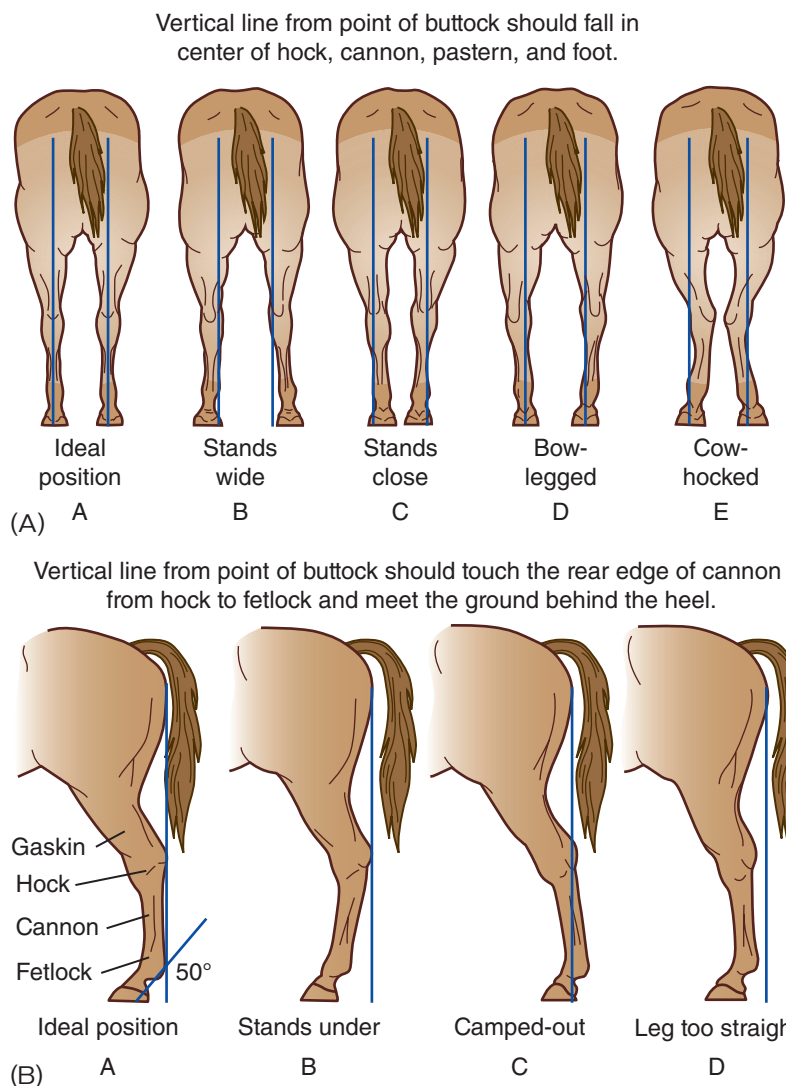
unsoundness

a defect that affects the usefulness of the horse

blemish

an imperfection that does not affect the usefulness of the horse

Unsoundness and Blemishes **Unsoundness** is a defect that affects the usefulness of the horse. Cataracts are an example of unsoundness. A **blemish** is an imperfection that does not affect the usefulness of the horse, such as an overbite (parrot mouth). Unsoundness in a horse is more serious than a blemish, and indicates that the horse is injured, ill, or diseased. Unsoundness usually implies that the

**FIGURE 21-22**

Correct and incorrect positions of the rear legs as shown from the rear (A), and as shown from the side (B).

horse is not able to be used for riding or pulling. The most serious unsoundness is any defect that affects the feet and legs.

Gaits

gait

the movement of the feet and legs when the horse is in motion

The **gait** of a horse describes the movement of the feet and legs when the horse is in motion. The walk, trot, canter, and gallop are the natural gaits of the most popular horses in the United States. Other gaits include the stepping pace, running walk, fox trot, amble, rack, and pace. These gaits are usually associated with specific breeds or training.

The walk is a slow, four-beat gait. Each foot leaves and strikes the ground separately from the other feet.

The trot is a fast, two-beat diagonal gait. Opposite front and hind feet leave and strike the ground at the same time. The canter is a slow, three-beat gait. The horse may lead from either the right or the left front foot. A western adaptation of a very slow canter is called the lope. The gallop is a fast, four-beat gait. Each foot strikes the ground separately. For a brief moment, all four feet are off the ground.



History Connection

High speed photography was perfected in the 1870s. In 1878 photographer Eadweard Muybridge used photography to prove that there is a moment in time when all four of a horse's feet come off the ground when it gallops.

Pedigree

Pedigree is of great importance when selecting pure-bred race and show horses. Other factors of selection such as conformation, soundness, and training are considered to be more important than pedigree.

Records

Health records should be kept for horses, either by the owner or by a veterinarian. Show horses and racehorses usually have performance/competition records readily available. Identification records should be kept for both registered and non-registered horses in case they are stolen or lost. Breed associations require special records that vary depending on the breed association. It is important to consider a horse's complete health record, and any other records, when selecting a horse.

Summary

About 75 percent of the horses in the United States are used for personal pleasure riding. There are many breeds of light horses, draft horses, and ponies. Most of the horses in the United States are classified as light breeds.

Size is not the only difference between ponies and horses. Draft horses are larger than light horses and ponies. There are few working draft horses in the United States today because of farm mechanization. Horses should be selected on the basis of conformation, use, age, sex, and soundness. Before any purchase, the horse should be thoroughly checked by a veterinarian. Breed selection is a matter of use and personal preference. Breeders and trainers are the best sources for the purchase of a horse. Horses may have a variety of unsoundness issues. The most serious unsoundness issues affect the feet and legs of the horse. Horse gaits are the various ways in which a horse can move. The common gaits are walk, trot, canter, and gallop. Many breeds have gaits specific to their breed. Pedigree may be considered when selecting a horse, but in most cases, conformation, soundness, and training are the most important factors.

Quick Facts

- The three main types of commercial horse enterprises are breeding, training, and boarding stables.
- The three states with the most horses are Texas, California, and Tennessee, in descending order.
- 65 individual breeds of ponies are available.
- There are over 200 distinct breeds of light horses.
- Light horses are used mainly for riding, driving, and racing.
- Face and leg markings are often used, along with the color of the horse, to identify an individual horse.
- The main breed of horse used in horse racing is the Thoroughbred.
- A donkey is smaller than a horse, has longer ears, and a short, erect mane.
- The five general uses of horses are: (1) pleasure, (2) breeding, (3) working stock, (4) show, and (5) sport.
- Two of the most important parts of the horse are the feet and legs. As with most breeds of livestock, if the feet and legs are not sound, then the animal should not be purchased or it should be culled.
- Unsoundness is a defect that affects the usefulness of a horse, such as cataracts.
- A blemish is an imperfection that does not affect the usefulness of a horse, such as an overbite (parrot mouth).
- The gait of a horse describes the movement of the feet and legs when the horse is in motion.

Student Learning Activities

1. Collect pictures that show the traits of different breeds of horses and display them on a bulletin board.
2. Survey the community to determine the most popular horse breeds and their numbers and uses.
3. Identify the parts of the horse on a photograph and label each part.
4. Estimate the age of a horse by examining its teeth.
5. Prepare a report on how to choose a horse.

Discussion Questions

1. What is the percentage of horses in the United States that are used for personal pleasure riding?
2. Approximately how many horses are there in the United States?
3. List several ways in which horses are beneficial to people.
4. Define the following terms: (a) foal, (b) filly, (c) colt, (d) mare, (e) stallion, (f) gelding.
5. List the five general uses of horses.

Review Questions

True/False

1. The horse industry is a minor business in the United States.
2. Most of the horses in the United States are draft breeds.
3. Pedigree and records should be considered when selecting a horse.
4. With today's technology, breeding, feeding, and caring for horses does not require a lot of labor.
5. Mules and hinnies are bred frequently with horses to produce more mules and hinnies.

Multiple Choice

1. Approximately how many people are involved in the horse industry?
 - a. More than 4.6 million
 - b. More than 3.5 million
 - c. More than 2.2 million
 - d. More than 1.7 million
2. Light horses are used mainly for:
 - a. riding
 - b. driving
 - c. racing
 - d. all of the above
3. What features of the horse can be used to determine age?
 - a. Eyes
 - b. Legs
 - c. Teeth
 - d. Hair coat
4. The earliest ancestor of the horse on record is:
 - a. Eohippus
 - b. Quahippus
 - c. Ectohippus
 - d. Zebrahippus
5. _____ were used as military horses during World War II in Europe.
 - a. Ponies of the Americas
 - b. Shetland Ponies
 - c. Quarter Horses
 - d. Haflinger Ponies

Completion

1. _____ and _____ are the two most important parts of the horse.
2. The _____ is the movement of the feet and legs of a horse when it is in motion.
3. _____ is the riding equipment and accessories used with horses.
4. There are over _____ distinct breeds of light horses.
5. The _____ is the most popular breed of horse in the United States.

Short Answer

1. List the five most popular breeds of light horses found in the United States.
2. What are the four natural gaits of a horse?
3. What are the withers, and how do you use them to determine the height of a horse?
4. Describe the difference between hot-blooded, cold-blooded, and warm-blooded horses.
5. What are the three leading states with the most horses?



CHAPTER 22

Management of Horses



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe good management practices for horses.
- Describe facilities required for horses.
- Identify common diseases and parasites of horses.
- Describe prevention measures for diseases and parasites of horses.



KEY TERMS

roughage
cecum
legume

hand breeding
broodmare
float

founder
colic
tack

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Bridle	Bride	Zaum	Briglia	La Brida
Gait	Démarche	Gang	Andatura	La Marcha
Mount	Mont	Untersatz	Monte	Montar
Horse Race	Course de Chevaux	Das Pferderennen	Corsa Ippica	La Carrera de Caballos
Saddle	Selle	Sattel	Sella	El Sillín
Tack	Bord	Tack	Tack	El Equipo de Caballo

Management of Horses

The management of horses and ponies is both time-consuming and costly. Horses usually need daily attention. With the right management, horses can remain healthy and bring years of enjoyment and pleasure. Horses require specialized feed, veterinary care, farrier care, and housing.

Feeding

roughage

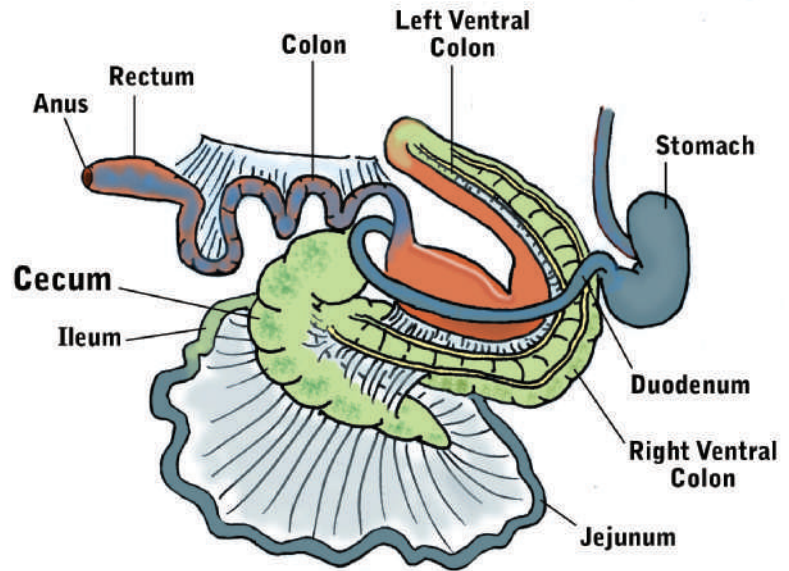
a high-fiber feed such as hay or pasture grasses

cecum

a large pouch in the large intestine which is the site of the digestion of cellulose plant fiber through the process of bacterial fermentation

Horses can utilize large amounts of **roughage**, a high-fiber feed such as hay or pasture grasses, in their feeding program. Much of the digestion of the roughage occurs in the large intestine. Bacteria in the **cecum** break down roughage into a form that can be utilized by the horse (Figure 22-1). The cecum in a horse is also known as the “hind gut” and is similar to the rumen in “true ruminants.” The cecum is a large pouch in the large intestine and holds about 7-8 gallons. The cecum digests cellulose plant fiber through bacterial fermentation.

Mature, idle horses and horses ridden occasionally can sometimes be fed on roughage alone. Growing foals and horses that are being ridden regularly, used for work, or are pregnant require additional feeding to meet their nutritional requirements.



Courtesy of Randy Glance

FIGURE 22-1

Fermentation of plant fiber takes place in the cecum, allowing digestion of roughages by horses.



Delmar/Cengage Learning

FIGURE 22-2

Good pasture can provide adequate nutrition for horses.

These horses need a higher percentage of proteins, carbohydrates, and fats in their diet to provide fuel and nutrition for the animal.

Pastures

Pastures are the easiest way to maintain a horse that is not working (Figure 22-2). With adequate pasture, horses are able to meet their body's nutritional maintenance requirements. Pasture grasses are an excellent source of feed for all horses, and the cost is minimal compared to other feeds which must be purchased by the pound or ton.

legume

a broad-leafed plant such as clover and alfalfa that is high in protein content.

The amount of pasture required per horse depends on the type and management of the grass. Pasture rotation is an integral part of horse management. Proper pasture rotation involves keeping pastures from being overgrazed and keeping parasites from becoming a problem. Pastures for horses include **legumes**, like clover and alfalfa, and warm-season and cool-season grasses. Legumes are broad-leafed plants that have a higher protein content than grasses.

Kinds of Pasture Grasses Pasture grasses are separated into two types of grass – warm-season grass and cool-season grass. Warm-season grasses show the most growth during the spring and summer months. Cool-season grasses show the most growth during fall and winter seasons.

Warm-season grasses include bermuda, bahia-grass, and orchard grasses. These grasses grow well in warmer climates, such as the southern United States. Bermuda, bahiagrass, and orchard grasses provide excellent nutrition for horses.

Cool-season grasses grow best in cool climates. These grasses include fescue, ryegrass, and bluegrass. Fescue is a good grass for horses, but should not be used with pregnant mares due to fescue toxicity. Ryegrass is a nutritious grass for horses but annual ryegrass has to be re-seeded each year. Bluegrass is a highly nutritious grass, and is considered to be the best all-around pasture grass for horses where it can be grown.

Hay

Legume hay may be made from alfalfa, clovers, peanuts, and lespedeza. Legume hays are more palatable than grass hays, but are more expensive. They also have a higher protein and mineral content. Alfalfa hay is one of the best of the legume hays (Figure 22-3). Grass-legume mixtures are often used for horse hay and make an excellent combination that can be used for feeding horses. Peanut hay is a high protein hay that is often fed to horses where available.

FIGURE 22-3

Alfalfa hay is one of the best of the legume hays.



©Stockphoto/Todd Arbini

FIGURE 22-4

A good quality commercial feed will usually provide horses with the proper nutrition.



Delmar/Cengage Learning

Common grass hays are timothy, orchard grass, and bermuda. Generally, grass hays do not yield as much feed per acre as legume hays. They tend to be lower in protein, calcium, and vitamins. Timothy hay has long been considered the standard hay for feeding horses. However, as with other grass hays, timothy hay is low in protein. Hay that is a mixture of grass and legumes provides roughage as well as a higher protein content than grass hay alone.

Commercial Feeds

Commercial grain or sweet feeds are popular for horses (Figure 22-4). Most commercial horse feeds are developed for a particular feeding program. The

FIGURE 22-5

It is important that horses have fresh, clean water daily.



directions on the feed tag should be closely followed. A commercially prepared feed will provide vitamins and minerals. Salt can be fed free-choice, allowing the animal to eat as much as it desires.

The use of a complete pelleted ration is gaining popularity. These rations are carefully balanced by the manufacturer. Convenience is an advantage of complete pelleted rations. There is often less waste when pelleted rations are used.

Water Horses drink 10 to 12 gallons (37.8–45.4 liters) or more of water per day (Figure 22-5). Work and performance horses drink more than this amount. Hot weather increases the need for water. A supply of fresh, clean water should be available at all times.

When working, horses must be watered at frequent intervals. However, horses that are hot should be cooled down and allowed to drink only small quantities of water at a time.

Breeding

As with other livestock, horses should not be allowed to become overweight when breeding or while pregnant. Overweight horses, both male and female, have problems with fertility, and the extra weight can put undue stress on the mare's body and the fetus when pregnant.

hand breeding

when a handler assists in the breeding process; the handler stands with the mare, usually in a breeding stall, and the stallion is brought in and allowed to mount the mare in a controlled environment

broodmare

a female horse used for breeding

Breeding the Mare

Horses have a low conception rate, averaging 50 to 60 percent. **Hand breeding** increases the conception rate. Hand breeding is when a handler assists in the breeding process. The owner or other handler stands with the mare, usually in a breeding stall, and the stallion is brought in and allowed to mount the mare in a controlled environment. Sometimes the mare's back legs are tied so that she cannot kick or injure the stallion. The **broodmare**, or mare used for reproduction, is more likely to conceive if bred in the months of April, May, or June.

If not bred, mares will continue to come into heat about every 21 days. The normal gestation period for a mare is 11 months.

Registered horses of all breeds, no matter when they are born, are considered to be born on January 1st of the year of their birth (Figure 22-6). For example, a registered horse that is born on January 5th and another that is born on December 25th of the same year are considered to be one year old as of January 1st of the following year.

Foaling Time

If the owner is not familiar with foaling procedures, a more experienced horseperson or a veterinarian should be contacted for assistance. Someone should be near the mare when foaling begins, although it is best to remain out of the mare's sight unless she needs assistance.



FIGURE 22-6

All registered horses are considered to be born on January 1st in the year of their birth.



Delmar/Cengage Learning

FIGURE 22-7

A horse's teeth may wear unevenly and will require floating (filing) by a veterinarian.

float

a long-handled rasp that can be either a hand tool or connected with an electric device used to correct the wear of horses' teeth

Health Plan

Horses should have routine veterinary care. This includes regular rotational worming, yearly vaccines, and yearly tests as required by law. Other services that can be provided by your veterinarian include floating of the teeth and joint and bone inspection. Check with your local veterinarian for a list of services and recommended vaccines and treatments.

Care of Teeth

Problems with a horse's teeth can sometimes cause the horse to refuse feed. The teeth often wear unevenly and develop sharp edges. These sharp edges may cut into the horse's cheek while chewing and cause pain. Indications of this problem include weight loss, drooling, dropping feed out of the mouth, and a reluctance to eat. The teeth should be filed with a **float** by a veterinarian to remove the sharp edges of the teeth (Figure 22-7). A float is a long-handled rasp that can be either a hand tool or connected with an electric device. Horses must be sedated to perform this treatment.

Controlling Diseases and Pests

Veterinary help will be needed for many diseases and disorders of horses. Even the most experienced horsepers on may become confused between the symptoms of disorders such as founder and colic.

Proper horse management requires at least a yearly visit from a licensed veterinarian. At this time, the veterinarian should be able to diagnose any health issues, as well as administer annual vaccinations and the Coggins test. A yearly Coggins test is required by law in most areas.

FIGURE 22-8

Blood tests can be done to determine if a horse is suffering from certain diseases.



Courtesy of Shannon Lawrence

Coggins Test – Equine Infectious Anemia

A Coggins test for Equine Infectious Anemia (EIA) is required when transporting a horse away from its farm. The Coggins test is a blood test that checks for Equine Infectious Anemia antibodies in a horse's blood (Figure 22-8). The test does not detect the virus itself, but it does detect the presence of antibodies in the blood.

EIA is a disease that affects horses, ponies, mules, and donkeys. It is transmitted via bloodsucking insects such as horseflies, deerflies, and less frequently, by mosquitoes. EIA occurs more on the Gulf Coast of the United States, where humidity and temperature are favorable for the transmission of this disease. Once infected, the animal is infected for life. There is no effective vaccine and no known cure. A positive test result on an animal means that the animal must stay quarantined from any other horses, mules, ponies, and donkeys for the remainder of its life.

Founder (Laminitis)

founder

inflammation of the sensitive tissues inside the hoof that causes lameness, resulting from a nutritional disorder

Founder, also called laminitis, is a nutritional disorder. Common causes are overeating of high concentrate feed, sudden changes in the type of feed, drinking too much water, or standing in a stall for long periods of time. It often occurs in the spring



Delmar/Cengage Learning

FIGURE 22-9

Founder is caused by a nutritional disorder or horses eating too much grain.

colic

a digestive disorder usually caused by a blockage in the intestine

when horses feed on rich spring grass. Founder causes lameness as a result of inflammation of the tissues inside the hoof (Figure 22-9).

Colic

Colic is a term that describes a series of problems encompassing a wide range of conditions that affect the horse's digestive tract (Figure 22-10). It is usually caused by some type of obstruction that blocks the flow of feed through the intestine, resulting in abdominal pain. The small intestine of a horse is about 70 feet long, and the large intestine is about 12 feet long. The long length, combined with the sharp curves and the shape of the intestine, make all horses vulnerable to colic. In the general horse population, colic occurs yearly in about 10% of all horses. It can be a dangerous, life-threatening illness, and steps can be taken to prevent it. When a horse shows signs of colic, it is important to act quickly, and call the veterinarian for severe cases.

Fescue Toxicity

Fescue toxicity affects pregnant mares. There is no treatment for fescue toxicity. Fescue toxicity can cause the mare to abort the foal or carry the foal longer than normal, causing the birth to be more difficult and possibly resulting in a stillborn foal. Pregnant mares should be removed from fescue pasture at least three months or more before foaling. Fescue toxicity is caused by a fungus living in the plant. The fungus makes a toxic chemical, and when the horse eats the fescue grass, it also eats the chemical from the fungus. The more fungus that the horse eats, the sicker it will become. There are fungus-free varieties of tall fescue available for pastures.



Delmar/Cengage Learning

FIGURE 22-10

Colic causes a horse to want to lay down and roll. It is important to keep the horse up and moving until a veterinarian arrives for treatment.

Poisonous Plants

Certain plants found in pastures and hay may be poisonous to horses. A few of the plants that are poisonous to horses are bracken fern, goldenrod,

horsetail, locoweed, oleander, ragwort, wild cherry, and tarweed. Should the horse consume any of these plants, call for immediate veterinary assistance. Call your local county extension agent for further identification of poisonous plants in your local region.

Equine Influenza (Flu)

Influenza is caused by a virus. It spreads quickly when large numbers of horses are brought together. Symptoms include a high temperature, lack of appetite, and a watery nasal discharge. Younger horses are more likely to become infected.

A vaccine may be used each year to prevent the flu. However, since there are several strains of viruses involved, the horse may be infected by a strain of the disease that was not protected by the vaccine.

Equine Protozoal Myeloencephalitis (EPM)

Equine Protozoal Myeloencephalitis (EPM) is caused by protozoan. It is a neurological disease of horses that has traditionally been difficult to diagnose. Symptoms can appear at any age, but most often occur in horses under 4 years of age. EPM is spread by the opossum. The opossum excretes sporocysts of the protozoan in its feces which may be accidentally ingested by horses in feed or while grazing. This disease is most prevalent in the southern United States.

The symptoms of Equine Protozoal Myeloencephalitis are similar to other neurological diseases. In order to be properly diagnosed, first the diseases of West Nile Virus, rabies, and viral encephalitis must be ruled out, because these diseases mimic EPM. The only way to be certain of the presence of this disease is to examine a horse after it has died. However, diagnostic tests have recently been developed to aid in the diagnosis of EPM.

Rabies (Hydrophobia)

Rabies is a disease caused by a virus. The virus enters the horse's body when it is bitten by an infected dog or other animal. An affected horse may become quite violent, sometimes attacking other animals or people. The affected animal will usually drool. The horse eventually becomes paralyzed and dies.

Tetanus (Lockjaw)

Tetanus is caused by bacteria. Bacteria usually enter the animal's body through puncture wounds or cuts. The horse becomes nervous and stiff. Muscle spasms and paralysis follow. Death usually occurs in untreated cases. Tetanus is prevented by vaccination and annual booster shots.

Encephalomyelitis – Eastern and Western

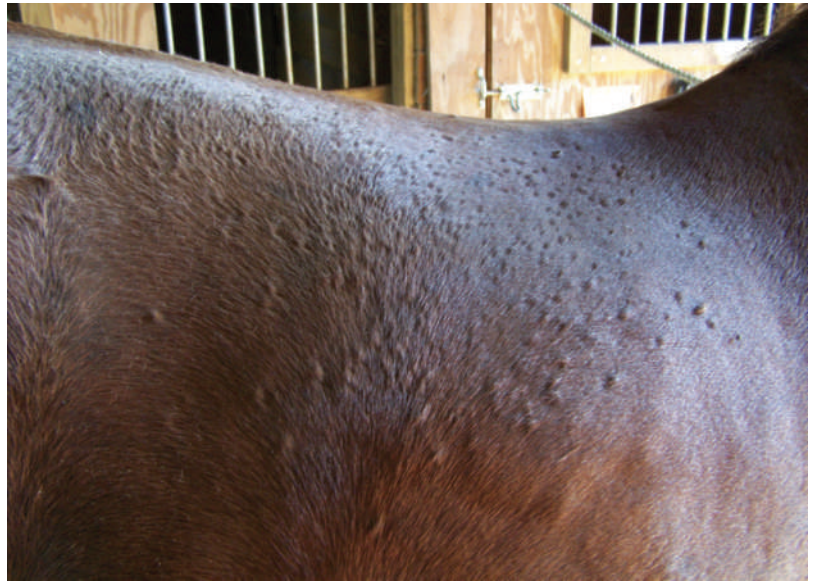
Encephalomyelitis (en-sef-uh-loh-mie-uh-lie-tis) is a disease that affects the brain, and may be caused by any one of several different viruses. The most common forms of the disease are known as Eastern and Western. The viruses are carried by mosquitoes. Symptoms of the disease include fever and chills, which then may progress to headaches and seizures. If the disease progresses this far, then a coma and death may result. The disease is fatal most of the time. Eastern and Western encephalomyelitis are prevented by annual vaccination. The vaccine EWT protects against Eastern and Western encephalomyelitis and Tetanus.

West Nile Virus

The West Nile virus causes encephalitis, or inflammation of the brain. The virus is most commonly spread by mosquitoes that have acquired the disease from infected birds. Mosquitoes can also transmit the disease to humans, other livestock, and poultry.

FIGURE 22-11

Rain rot, while not life threatening, is a problem with horses especially in warm, humid weather.



Delmar/Cengage Learning

It is generally recommended that horses be vaccinated for West Nile virus. The vaccines have been shown to be highly effective in preventing the disease. Protecting animals from mosquitoes is also important in controlling the disease.

Rain Rot/Rain Scald

Rain rot, also called rain scald, is a common skin infection seen in horses (Figure 22-11). The organism that causes rain rot appears and multiplies in warm, damp conditions where high temperature and high humidity are present. The southeastern United States, especially Florida, experiences these conditions for at least six months out of the year.

This condition is not life-threatening. It will appear as dozens of scabs all over the horse's body that can be easily scraped off. There are commercial medications available that will help to control rain rot.

External Parasites

External parasites of horses include flies, lice, mites, and ticks. Most of these parasites also attack beef cattle and other livestock.



Courtesy of N. Hinkle

FIGURE 22-12

Horseflies are a nuisance for both humans and horses.

Horse Botflies

Horse botflies produce larvae that are parasites of horses. Botflies lay their eggs on the hairs of the horse's coat, usually during the early summer months. One egg will attach to one hair of the horse, on the legs, belly, flanks, shoulders and mane. One female botfly can lay up to 1000 eggs on a horse's body. The eggs are long and skinny as they are attached to the hair, and are pale to grayish yellow in color. The larvae enter the horse through the mouth and migrate to the stomach. After nearly a year of development, the larvae pass out of the horse in the feces. The larvae pupate, and adult flies then emerge and begin the cycle again.

Biting Midges, Horseflies, Deer Flies, Black Flies, and Mosquitoes

Biting midges, horseflies, deer flies, black flies, and mosquitoes often feed on the blood of horses and other animals. Horseflies and deerflies irritate animals, causing pain and discomfort. These flies also feed heavily on blood (Figure 22-12).

Internal Parasites

More than 75 different species of internal parasites affect horses. The most important of these are strongyles, ascarids, and pinworms. Internal parasites are so widespread that all horses are affected by them. Heavy infestations of internal parasites lead to poor physical condition.

A good prevention program, including rotation of dewormers, should be used. The dewormers should be rotated because no one drug is effective against all of the different kinds of worms. The most common dewormers on the market today are oral dewormers. Most horses should be regularly dewormed every 6–8 weeks.

The eggs of the worms pass out in the feces of the horse. Therefore, proper handling of manure helps in controlling these parasites. Do not overstock (overgraze) pastures with too many horses per acre. Overstocked pasture forces horses to graze around dung piles, increasing the risk of infection. Rotational grazing helps break the life cycle of the worms. Place hay and grain in mangers or bunks rather than on the ground. Be sure that the water supply is clean.

Life Cycles

The life cycles of strongyles, ascarids, and pinworms are very similar. Eggs are passed out in the feces. They develop to the infective stage on vegetation or in litter, or the eggs hatch and the larvae attach to vegetation. Horses pick up infective eggs or larvae from grazing on infected grasses or from contaminated water. The eggs hatch inside the horse's intestines and grow into infective larvae. The larvae can remain in the intestines, or they can migrate through the tissues of the horse's body. Larvae develop into mature worms and lay eggs, beginning the cycle again.

Large and Small Strongyles Strongyles are worms that are grouped as either large or small, and both types can infect horses. Large strongyles migrate to the arteries, liver, and gut wall. Adult large strongyles are bloodsuckers, burrowing into the walls of the arteries that supply blood and feeding on the blood. Anemia and weakness may result if there is a large enough blood loss. Large strongyles are considered to be the most serious of the internal parasites. Small strongyle larvae migrate to the intestine, but they do not go beyond the walls of the intestine. There they cause digestive problems.

Ascarids Ascarid larvae burrow into the small intestine, and can migrate through the veins to the heart, liver, and lungs. Later they are coughed up, re-swallowed, and go back to the small intestine where they mature to adults and produce eggs. They are

not bloodsuckers. They are the largest of the worms that affect horses, and can be up to 15 inches long. During the migration through tissues, physical damage can occur such as inflammation and the scarring of liver and lung tissues. They may rupture the wall of the small intestine and cause death.

Pinworms Unlike other internal worms, pinworms do not migrate through any organ tissue. The only damage that pinworms cause to a horse is the itching of the tail head. These worms are about a half inch in length. Pinworms live their life in the colon of the horse. The mature female pinworms crawl out of the rectum of the sleeping or relaxed horse at night and deposit their eggs around the anus. Although pinworms cause irritation, there is little physical damage done to the horse.

Shelter

Horses do not require elaborate or expensive barns. They do need a shelter that will protect them from the cold, storms, sun, and wind (Figure 22-13). A horse barn or shelter should be located in an area with good drainage. A structure with good ventilation and a lack of drafts is important.

Floors made of sand, soil, gravel, or wood are better for horses than floors made of concrete. Straw or wood shavings make good bedding materials



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FIGURE 22-13

Horse shelter in a pasture.

for horses. Removal of manure from the barn and premises helps to reduce the fly population as well as odor.

Equipment for Feeding and Watering

A hayrack or manger reduces waste when feeding horses. A grain feeder may be attached to the wall of a stall or placed on a wooden shelf. It should be easily removable for cleaning. Provisions should be made for supplying fresh, clean water. A water tank or trough may be used.

Tack

tack

any equipment used for horseback riding, including the harness, saddle, bridle, reins, and stirrups

Tack is any equipment used for horseback riding, including the harness, saddle, bridle, reins, and stirrups. The type of tack for a horse depends on the purpose of the horse. Tack generally includes all the equipment needed for the maintenance and riding of the horse. If showing the horse in a show or rodeo, the type and brand of equipment should be of a higher quality than that of a trail horse.

Tack is expensive and should be given proper care (Figure 22-14). Different materials are used to make saddles. Leather and synthetics are the two primary types of saddle materials. Leather should be cleaned and oiled regularly. Several kinds of oils are

FIGURE 22-14

Tack should be kept in a room with moderate temperatures where it can be kept dry to prevent damage to the leather.



available for use on leather. Select one that does not rub off on clothing. Synthetic saddles do not require as much cleaning, but often are not as long-lasting or durable as leather. Repair or replace any parts of the tack that become worn or broken.

When purchasing tack for the horse and rider, the following should be purchased:

1. **Halter and Lead Rope:** The halter should be the correct size and not too tight or too big on the horse. A halter that is too tight will be uncomfortable for the horse. A halter that is too loose will not offer the handler enough control over the horse. The lead rope should be at least 5–6 feet long to provide enough rope length to securely tie the horse.
2. **Saddle Pad/Blanket:** A saddle pad or blanket should be chosen that will give the horse the most protection from the pressure points of the saddle. The pad should be larger than the saddle to be effective. Saddle pads for horses are usually thicker than those for ponies. Ponies carry extra fat around their bones, whereas horses do not, which means that an adult horse has less natural protective padding. A thicker saddle pad provides extra protection for a grown horse and alleviates any possible pressure points and pain from the saddle.
3. **Bridle and Bit:** A bridle and bit are the steering components for the horse. A bridle should be a sturdy piece of equipment that is both comfortable for the horse as well as the rider. The bit should be placed in the horse's mouth and adjusted to fit properly. Ask an experienced horseperson to help adjust the bridle. Depending on the horse, the bit can be as little as a halter and as much as a heavy metal bar in the mouth. Each horse is different and will require a different bit.

**FIGURE 22-15**

Horse grooming equipment.

4. **Brushes and Grooming Aids** (Figure 22-15): Grooming is an important part of being responsible for the horse. Riders and horse owners should have a variety of brushes and grooming tools to effectively groom the horse. Horses usually enjoy being groomed. When grooming, the rider should brush the entire body of the horse and comb or brush through the mane and tail. The hooves should be cleaned with a brush and hoof pick that removes mud, stones, and other objects that have been compacted in the underside of the hoof. Grooming should be done at least every other day, and always before riding. Horses that become sweaty during activity should be washed to help remove dirt and debris from the skin and hair coat.
5. **Saddle:** A correctly-fitting saddle for the rider and the horse is imperative. An ill-fitting saddle can cause the rider pain, and can also injure the horse. Prolonged use of an ill-fitting saddle can even cripple a horse.

Riding Equipment

Different specialty tack and equipment is required depending on the type of horse and the kind of riding that is to be done. For example, the tack and equipment required for trail riding is much different than the tack and equipment required for dressage. Inexperienced riders should check with a trainer or a person knowledgeable about horse shows to find out what tack will be required. There are two basic types of saddle: English and Western. English saddles are built to maximize contact between the horse and rider, and are usually only used for short periods of time. Western saddles are heavier and

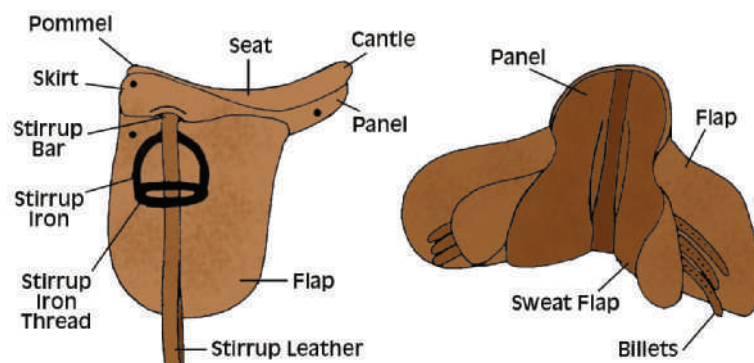
distribute the weight of the rider across the horse's back, making it more comfortable for the horse to be ridden all day.

Western Riding Equipment

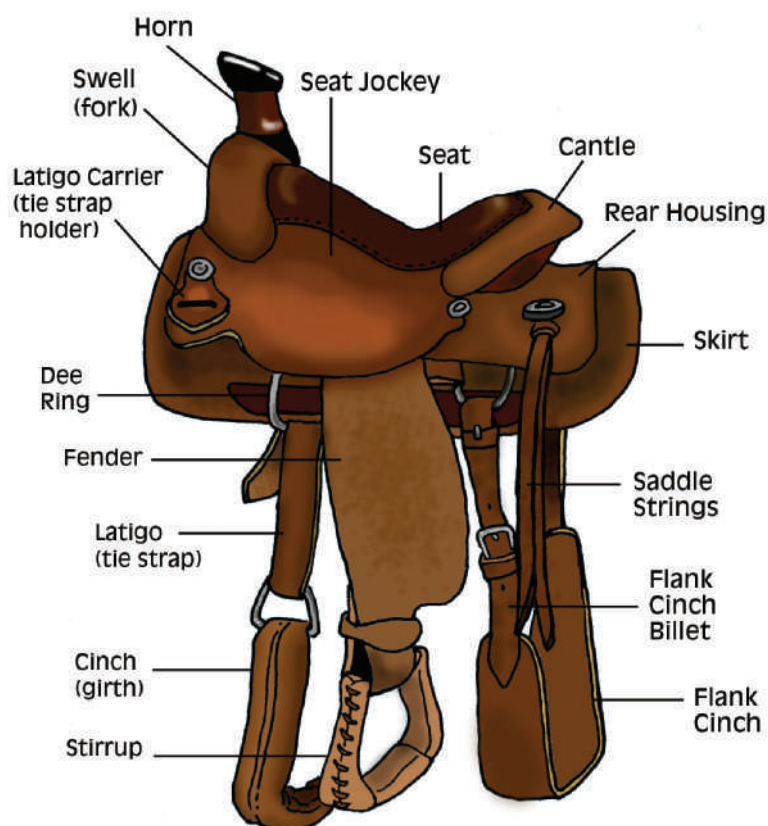
Western riding is when a person uses a Western or stock saddle. These saddles are often heavy and large, but are more durable and comfortable than other saddle types. Western saddles are made for the comfort of the horse as well as the rider. A Western saddle has a raised swell (front part of saddle) with a horn, and a raised cantle (back part of saddle). See Figure 22-16 for parts of the Western saddle. A saddle pad or blanket is always used with a Western saddle. Saddle pads should be inspected and cleaned regularly to prevent damage and harm to the horse. Western bridles and bits are different from their English counterparts in that they are meant to be ridden with a loose rein rather than a tight rein.

English Riding Equipment

English riding is when a person uses an English saddle. English saddles are much lighter than Western saddles. An English saddle can have a raised cantle or could be flat, depending on which version of the saddle the rider chooses. The smaller, lighter English saddle is made so that the rider is in close contact with the horse. The rider is more upright in the saddle, and can place his or her legs close to the horse's sides. See Figure 22-16 for parts of the English saddle. A saddle pad or blanket is optional when riding with an English saddle, as most of them have built-in padding. The bridle and bit used in English riding are meant to be ridden with a tight rein, or close contact with the horse's mouth.



(A) English saddle



(B) Western saddle

FIGURE 22-16

The parts of the (A) English saddle and the (B) Western saddle.

Courtesy of Randy Glance

Fences

Fences built of wood or poles are a good choice for horses (Figure 22-17). Woven wire may be used, although the mesh must be small enough to prevent the horse from catching its hooves in it. Barbed wire is commonly used for horses, although not recommended. Horses can easily be hurt on barbed wire.

**FIGURE 22-17**

Various fencing options: (A) metal piping, (B) wire mesh, (C) PVC plank, (D) wood.

All fences should be easily visible to the horse. To make fences visible, a board may be run along the top or flagging can be used.

Summary

Mature, idle horses can be fed on a ration composed solely of roughage. Grass and legume pastures can provide much of the roughage required by horses. Legume and grass hays are good sources of roughage for horses. Horses that are working, pregnant mares, and growing foals need extra protein sources in their feeding program.

Commercial feeds and complete pelleted rations may be used for feeding horses. Horses require salt, which can be fed free-choice allowing the animal to eat as much as it desires. Additional vitamin supplements are seldom necessary. A clean, fresh supply of water should be available for horses at all times.

Horses are fed according to their size, stage of growth, condition, and the amount of work they perform. Regular feeding and watering is important. An attendant should be present during foaling in case the mare has difficulty giving birth. Horses do not need expensive shelters. Protection should

be provided from the cold, storms, wind, and sun. Fences may be wood or wire. Watering and feeding equipment should be designed for easy cleaning.

A new horse owner will need to purchase the following equipment: a halter and lead rope, a saddle, a saddle pad/blanket, a bridle and bit, brushes, and other necessary grooming aids. The types of equipment the owner will need to purchase will vary depending on the type of riding.

Quick Facts

- Horses can digest large amounts of roughages such as grass and legume hay.
- With adequate pasture area, horses are able to meet body maintenance requirements.
- A mix of grass and legume pasture makes excellent feed for horses.
- There are two types of pasture grass based on the season of growth – warm-season grass and cool-season grass.
- Most commercial horse feeds are formulated for a particular feeding program.
- Horses have a low conception rate, averaging 50 to 60 percent.
- Veterinary help will be needed for many diseases and disorders of horses.
- Certain plants found in pastures and hay may be poisonous to horses.
- Encephalomyelitis is a disease that affects the brain and may be caused by any one of several different viruses.
- West Nile virus causes encephalitis, or inflammation of the brain.
- External parasites of horses include flies, lice, mites, and ticks.
- More than 75 different species of internal parasites affect horses.
- A float is a long-handled rasp used to file a horse's teeth.
- Horses do not require elaborate or expensive barns.
- Tack includes any equipment used for horseback riding, such as the harness, saddle, bridle, reins, and stirrups.
- Fences built of wood or poles are a good choice for horses.

Student Learning Activities

1. Visit horse owners in the area and inquire about the feeding and management practices that are followed.
2. Give an oral report on the feeding of horses and/or management practices for horses.

3. Research the English and Western riding styles. Create a collage of the different equipment needed for each riding style.
4. Give an oral report on housing and equipment for horses.

Discussion Questions

1. Describe housing options for horses.
2. Name and describe five horse diseases/ailments.
3. What are the different kinds of hay? Give examples of each.
4. What is a broodmare? Why is the health of a broodmare important?
5. What is floating of a horse's teeth?

Review Questions

True/False

1. Pregnant mares and growing foals do not require extra feed in addition to roughage.
2. Fescue toxicity only affects pregnant mares.
3. Orchard grass is a warm-season grass.
4. Bluegrass is not a highly nutritious grass.
5. Water is not important in horse feeding.

Multiple Choice

1. The _____ is a large pouch in the large intestine and aids in roughage digestion.
 - a. cecum
 - b. larynx
 - c. pancreas
 - d. colon
2. What does EPM stand for?
 - a. Equine Premature Mitochondria
 - b. Equine Protozoal Myeloencephalitis
 - c. Equine Protozoal Movement
 - d. Equine Preventive Movement

3. What is the average conception percent rate for horses?
 - a. 10–20
 - b. 30–40
 - c. 50–60
 - d. 80–90
4. Horses drink _____ gallons of water a day.
 - a. 1 to 2
 - b. 4 to 6
 - c. 8 to 10
 - d. 10 to 12
5. Shelter for horses should be which of the following?
 - a. expensive
 - b. drafty
 - c. safe
 - d. damp

Completion

1. _____ is a disease that affects the brain, and may be caused by any one of several different viruses.
2. Fences built of _____ or _____ are the best choice for horses.
3. Horses will normally eat large amounts of _____, such as grass.
4. There are two types of pasture grass based on the season of growth, _____ grass and _____ grass.
5. _____ is when the horse owner assists in the breeding of the stallion and the mare.

Short Answer

1. What day of the year are registered horses of all breeds considered to be born?
2. What type of fencing is needed for horses?
3. What equipment is required for feeding and watering horses?
4. Briefly explain the difference between cool-season grasses and warm-season grasses. List some examples of each.
5. Name five diseases and disorders that can affect horses.



CHAPTER 23

Training and Horsemanship



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe the characteristics of horse behavior.
- Outline the general rules for handling horses.
- Explain methods of training a horse.
- Describe the different types of riding.



KEY TERMS

ground training
haltering

longeing

endurance riding

LANGUAGE CONNECTION

English	French	German	Latin	Spanish
Gait	Démarche	Gang	Incessus	La Marcha
Horse	Cheval	Pferd	Equus	El Caballo
Horseshoe	Fer à cheval	Hufeisen	Ferrum	La Herradura
Mane	Crinière	Mähne	Decursus	El Crin
Mount	Monter	Montieren	Conscendo	Montar
Race	Course	Rennen	Curriculum	La Carrera
Saddle	Selle	Sattel	Ephippium	El Sillín

Understanding Horse Behavior

The behavior of horses is based upon survival instincts that have developed over a period of several million years. The ancestors of the horse were able to survive by being alert and quick, hiding, running from danger, and adapting to changing conditions. Several things to consider when handling a horse are:

- ◀ A horse's eyes see independently.** Horses can see to the front and sides at the same time. They have a nearly 360 degree field of vision because their eyes are positioned far apart (Figure 23-1). But the picture that each eye sees doesn't overlap as much as in humans, so a horse's ability to judge height and distance is not as good as compared to humans. Horse eyes adjust to changing light conditions slower

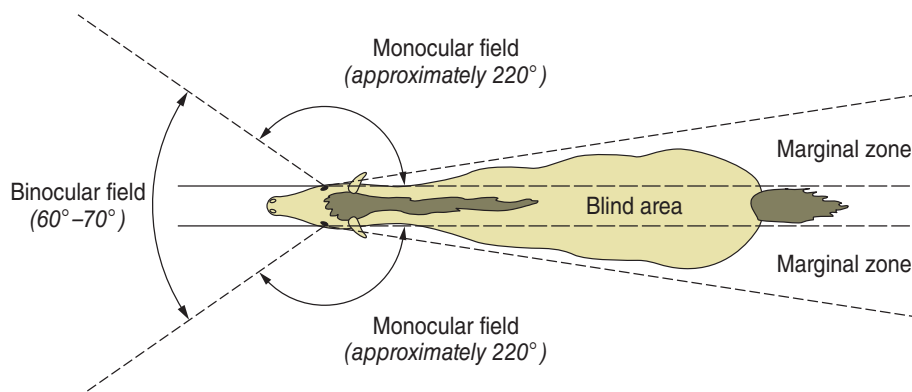
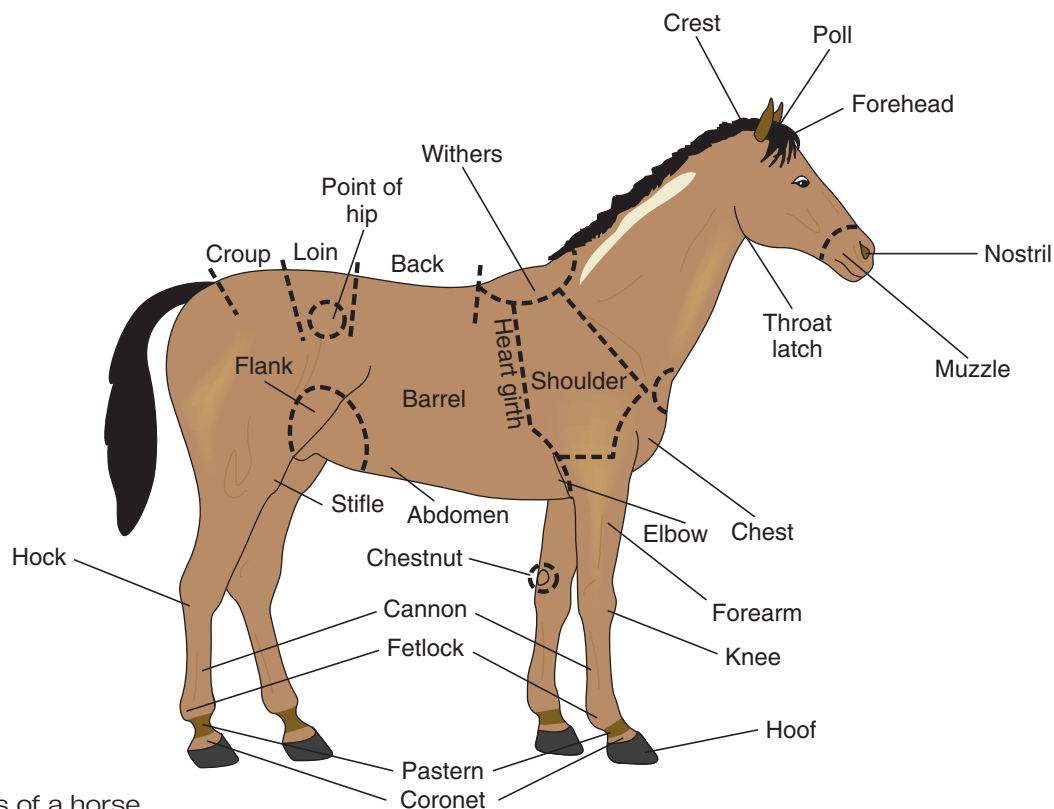


FIGURE 23-1

A horse's visual field.

than human eyes. While many people believe that horses are colorblind, no scientific proof exists to confirm this belief. Horses react quickly to sudden movement, which is why a horse will sometimes shy and throw a rider at the sudden movement of an object.

- ▶ **Horses have good memories.** Therefore, they can be trained and will remember what they learned. Horses remember the rewards and punishments they are given. Reward or punishment must be given immediately following the desired or undesired behavior so that the horse will associate the two.
- ▶ **Horses band together.** The banding instinct also means that horses imitate the behavior of other horses. This has application when riding in a group. When one horse in a group misbehaves or bolts, calmer horses will also often react in the same manner.
- ▶ **Horses generally have good hearing.** They are able to hear tones higher than the human ear can hear. A sound that the rider does not hear may frighten the horse.
- ▶ **Horses have a good sense of smell.** A stallion can detect a mare in heat from a great distance if he is downwind from her. A colt should be allowed to smell the saddle and blanket the first few times it is saddled. This helps to reassure the colt that these are not dangerous objects.
- ▶ **Horses have several areas on their bodies that are particularly sensitive.** These include the mouth, feet, flanks, neck, and shoulders (Figure 23-2). These sensitive areas are used in training and controlling the horse. The rider communicates to the horse through the voice, hands, legs, and weight. The horse can learn and remember voice commands. The sensitive mouth of the horse responds to the control of the bit. The legs of the rider can direct the horse by applying pressure to sensitive areas of the skin. The horse is able

**FIGURE 23-2**

The major body parts of a horse.

to sense the security or lack of security of the rider by the way the rider uses his or her legs. An insecure rider cannot obtain the best performance from a horse.

Training a Horse

Training a horse requires skill, patience, and careful handling. Handling a foal while it is young makes the job easier. Only an experienced horseperson should be responsible for training any horse. A professional horse trainer has both the skills and patience for dealing with behavioral and learning issues.

Ground Training

Ground training should start when the horse is at a young age so that trust is built between the horse and humans. The basic ground training steps are: halter training, leading, tying, and then longeing.

ground training

teaching a horse to wear a halter, lead, tie, and longe

haltering

teaching a horse to accept that the handler is in control by putting a halter on the horse

Haltering **Haltering** or halter training is teaching the horse to accept that the handler is in control. The halter is a headpiece for leading or controlling the animal. Every aspect of good horsemanship promotes the safety of the horse and rider, and the humane treatment of the horse. When approaching a horse for haltering, the rider should approach in a quiet and relaxed manner.

The rider should approach slowly, making sure that the horse notices his or her presence before coming too close. Riders should never assume that a horse is aware of their presence. If a horse is startled, the risk of injury increases for both the horse and the rider. After reaching the horse, the rider should slowly reach out with his or her arm under the jaw of the horse to the other side of the face and stroke the horse's face. The rider should then slowly reach up with his or her other arm and put the halter over the horse's neck just behind the ears (Figure 23-3). Haltering will become easier with patience and practice.

Leading When leading a horse, the manner in which a rider positions his or her body relative to the horse's body is very important. The safest place for a person to be is at the horse's shoulder facing



FIGURE 23-3

When haltering the horse, a calm, steady approach is best.

FIGURE 23-4

Proper positioning for leading the horse.



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forward (Figure 23-4). This way, the horse can see the rider and his or her actions, and the rider can also sense if the horse is reacting to other stimuli. Horses should only be led with a properly fitted halter and lead rope. The rider's hand should be at the buckle under the horse's chin between the halter and lead rope. The remainder of the lead rope should be held firmly in the other hand.

Tying Always tie a horse to a stable object free from any hazardous items that could injure the horse (Figure 23-5). The horse should be tied using a knot that will not slip and that can be untied quickly. Horses should be tied at the horse's eye level or above. The horse's nose should not be able to touch the ground. Make sure that the horse and rider both have room to move without coming into contact with any object or horse that could possibly cause a conflict.

longeing

training a horse to perform various gaits at the end of a long rope

Longeing Longeing (pronounced "lunging") is training the horse to perform different gaits at the end of a 25- to 30-foot line. If a longe line is not

**FIGURE 23-5**

When tying a horse to a stable object, be sure the knot will not slip, but can be untied quickly in case of an emergency.

**FIGURE 23-6**

Longeing is an effective training technique used by horse trainers and owners.

available, a round pen will help with this process. One end of the line is fastened to the halter, and the trainer holds the other end. The trainer attempts to make the horse move in a circle (Figure 23-6). Training begins with a small circle, and as the horse learns to respond to commands, the circle is enlarged. A light whip may be used to start the horse moving.

The horse should never be hit with the whip; touching the horse's rump or hind legs is all that is needed.

A horse can be taught to respond to voice commands. The same commands should always be used so the horse learns to associate the commands with the action. These commands should be the same as those commands that will be used when the horse is being ridden. The longe line can be used to train and exercise a horse that is not ridden often. Horses that are not ridden often may need to be longed before riding to prevent injury.

Mounting

After the horse's ground work is completed, a rider may prepare to mount and ride the horse. Before mounting a horse, all equipment should be checked to make sure the saddle and bridle are adjusted properly. A horse is always mounted from its left side, called the near side. The left foot of the rider is placed in the stirrup. The left hand holds the reins and this hand is placed on the neck of the horse just in front of the withers. The right hand grasps the cantle or pommel of the saddle. The rider sometimes takes one or two hops on the right foot to gain momentum and springs up. A riding block is sometimes used to give smaller riders a boost. The right leg is swung over the horse, taking care not to touch the rump of the horse (Figure 23-7). The weight



History Connection

The horse is always mounted from the left because of military tradition. When soldiers wore swords, they always wore them on the left side of their body so they could be drawn with the right hand. Mounting on the left side of the horse allowed the sword to hang undisturbed during the process, and prevented riders from causing harm to themselves or their horses.

**FIGURE 23-7**

A The horse is mounted from the near side (left side). **B** To begin, place the left foot in the stirrup. **C** Push off the left foot and swing the right leg over the horse's back.



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is shifted to the left leg to maintain balance. The right foot is slipped into the stirrup before the body weight is settled into the saddle.

Forms of Riding

The type of riding that will be done usually dictates the equipment to be used. There are two basic types of riding, English and Western. Different types of saddles are used for different riding styles. Each type of saddle offers a different comfort level for the rider.

Pleasure Trail Riding

For the person who wants to trail ride, either the English or Western saddle will work. It is a personal preference as to which saddle and bridle combination works best for the rider and the horse.

Both the rider and the horse should prepare for trail riding. The rider must develop the endurance needed for trail riding to avoid soreness. Short rides each day for approximately two weeks before the trail ride will help both the rider and the horse prepare and build endurance for the trail ride. The horse

must be properly fed and conditioned, and must become used to the kinds of obstacles that may be encountered on trail rides, such as creeks, logs, or gates.

Before heading out to ride the trails, there are a few rules to follow. Trail riders should always go with a partner or group of people (Figure 23-8). It is not safe to ride alone. The rider or the horse could be injured, lost, or in trouble, and there would be no one to help if the rider is alone. Riders should always check the riding equipment prior to trail riding to make sure that it is all in good working order. If the rider is taking the horse away from the farm, health papers from a veterinarian, extra water, and a first aid kit should be packed and brought. When leaving the vehicle, riders should leave a note in the front window of their truck that states the route they are taking, when they left, and when they expect to return, in case something happens.

When returning from the trail ride, riders must check all the riding equipment and replace any worn or damaged pieces. Riders should also check for ticks and burrs. Riders should survey the horse's body to make sure there are no cuts, parasites, or abrasions that should be tended to immediately. Upon returning home, the rider should rinse the horse and brush it to remove any excess hair, sweat, and dirt.



Courtesy of APHA/ Ross Hecoxtrail

FIGURE 23-8

Trail riding should always be done in groups for safety.

Showing

Horse shows are usually broken down into separate sections: English, Western, and timed events. Some horse shows are specialty shows and have only one of the above classifications. The broad categories of English riding competition seen primarily within the U.S. include English pleasure, hunter hack, equitation, halter showmanship, and jumping classes (Figure 23-9). Table 23-1 provides a description of the events.



FIGURE 23-9
Jumping is one event commonly found in a horse show.

TABLE 23-1

Description of Common Events in a Horse Show

Hunter Hack	Horse is led around the arena, showing off the horse’s conformation.
Halter Showmanship	Horse is led around the arena, and the contestant is judged based on the handling of the horse.
English Pleasure	Horse is ridden in the arena at 3 to 4 gaits, for example: walk, trot, canter, and either/or extended trot and hand gallop. Horse and rider are judged on performance.
English Equitation	Horse is ridden in the arena at 3 to 4 gaits. Rider is judged on riding skills.
Jumping	Horse is ridden over a series of obstacles (usually to a certain height) that the horse must clear.

The competitive classes of a Western show include halter, Western pleasure, showmanship, trail, reining and Western horsemanship (Figure 23-10). These events are described in Table 23-2.

Timed events include barrel racing, pole bending, and cones (Figure 23-11). These events are described in Table 23-3.

Rodeos are competitive for horses as well as the riders. In rodeos, horses perform not only timed events such as barrel racing and team roping, but are used in saddle bronc or bareback bronc riding.



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FIGURE 23-10

Judging at a Western event.

TABLE 23-2

Description of Events at a Western Horse Show

Halter	Horse is led around the arena, showing off the horse's conformation.
Showmanship at Halter	Horse is led around the arena, and the contestant is judged based on the handling of the horse.
Western Pleasure	Horse is ridden in the arena at 3 gaits. Horse and rider are judged on the performance of the gaits.
Western Horsemanship	Horse is ridden in the arena at 3 gaits. Rider is judged on riding skills.
Trail	Horse is ridden through a set of obstacles that are designed to resemble situations that a horse and rider might actually encounter when on a trail in a natural habitat.
Reining	Horse is put through a complex pattern, usually at a very fast pace.



FIGURE 23-11
Barrel racing is an example of a timed event in a horse show.

TABLE 23-3
Descriptions of Timed Events

Barrel Racing	The horse and rider complete the course around preset barrels as fast as possible. Although there are several different patterns for barrel racing, the most popular is the cloverleaf pattern.
Pole Bending	The horse and rider must complete the course, weaving through 6 poles in a specified pattern without knocking over a pole.
Cones	The horse and rider must complete the course, weaving through 5 cones in a specified pattern without knocking over a cone.

endurance riding
riders complete a 25, 50, or 100 mile course for the best completion time

Endurance Riding
Endurance riders complete a 25, 50, or 100 mile or more course for the best time. At each checkpoint in the race, a veterinarian must clear the horse to continue. This course is truly an endurance course, sometimes including mountains, rocky terrain, and swamps and lakes. Most horses on the endurance circuit are Arabians or Arabian crosses.

Summary

The behavior of horses is based upon survival instincts, including the banding instinct and a refined sense of hearing, smell, and touch. The horse also has several characteristics that influence its behavior, including its independently moving eyes. Horse trainers are constantly aware of a horse's natural instincts and reactions. Training a horse requires haltering, tying, leading, longeing, mounting, and saddle training. Forms of riding include pleasure riding, Western and English showing, and endurance riding, all of which challenge the rider and the horse to perform successfully.

Quick Facts

- The behavior of horses is based upon survival instincts that have developed over a period of several million years.
- A horse's eyes see independently, allowing a nearly 360 degree field of vision
- Horses have good memories, facilitating training.
- Horses band together.
- Horses generally have a good sense of smell and good hearing.
- Horses have several areas on their bodies that are particularly sensitive – the mouth, feet, flanks, neck, and shoulders.
- Only an experienced horseperson should be responsible for training any horse.
- Every aspect of good horsemanship promotes the safety of the horse and rider, and the humane treatment of the horse.
- The safest place for a person to stand is at the horse's shoulder facing forward.
- Always tie a horse to an anchored and stable object, free from any hazardous items that could injure the horse.
- Longeing is training the horse to perform different gaits at the end of a 25- to 30-foot line.
- A horse can be taught to respond to voice commands.
- Riders should always mount a horse from its left side, called the near side.
- Trail riders should always go with a partner or group of people.
- The two basic types of riding are English and Western.
- Horse events and activities include trail riding, endurance riding, and showing.
- Horse shows include English or Western styles and timed events.

Student Learning Activities

1. Observe a demonstration on training a young horse.
2. Observe demonstrations on haltering, bridling, saddling, mounting, dismounting, and riding horses.
3. Attend horse shows to observe correct procedures.
4. Have a professional horseman talk to the class about training.
5. Visit a dressage training facility to learn different training techniques.

Discussion Questions

1. Name the sensitive parts of a horse's body.
2. Name four ways that a rider communicates commands to a horse.
3. Describe the proper procedures for (a) haltering, (b) leading, and (c) longeing.
4. Describe how the tack aids a rider in controlling his horse.
5. List the different sections of horse shows.

Review Questions

True/False

1. Leaving the halter on a foal for a short period of time will help the young horse to get used to wearing it.
2. There is scientific proof that horses are colorblind.
3. The horse is able to sense security or a lack of security in the rider.
4. Horses prefer to be alone.
5. When leading a horse, it is permissible to let the remainder of the lead rope drag on the ground.

Multiple Choice

1. Longeing is training a horse at the end of a _____ to _____ foot line.
 - a. 5; 10
 - b. 15; 20
 - c. 25; 30
 - d. 35; 40
2. Which of the following are types of riding?
 - a. endurance
 - b. showing
 - c. trail
 - d. all of the above
3. Which of the following is NOT a sensitive area on a horse's body?
 - a. mouth
 - b. hock
 - c. feet
 - d. flanks
4. A horse is always mounted from:
 - a. its left side
 - b. its right side
 - c. behind
 - d. diagonally from the right shoulder
5. When going on a trail ride, the rider should begin to prepare by:
 - a. taking short rides
 - b. going to the chiropractor
 - c. laying on the couch
 - d. thoroughly brushing the horse

Completion

1. When mounting, make sure the _____ doesn't touch the rump of the horse.
2. There are two basic forms of riding equipment: _____ and Western.
3. The _____ means that horses imitate the behavior of other horses.
4. When approaching a horse for haltering, the rider should approach in a _____ and _____ manner.
5. The saddle and _____ should be adjusted properly before mounting a horse.

Short Answer

1. Name three items of tack a rider uses to control a horse.
2. On which side should a horse be mounted?
3. List the two general types of riding (equitation).
4. Name some typical events included in a rodeo.
5. List the preparations that are necessary for trail riding.



Section 8

POULTRY

CHAPTER 24 Introduction to Poultry Production

CHAPTER 25 Management of Poultry

CHAPTER 26 Poultry and Egg Quality

FFA AND 4-H CONNECTION



Poultry makes a great project for youth, such as FFA and 4-H members, because of the low cost, small size, and availability. The following is a partial list of activities in which a student may participate using knowledge obtained in a poultry program. Students should consult local and state youth organizations, such as the National FFA Organization and 4-H, to determine which poultry-related programs are available in their area.

- Agricultural Marketing
- Agricultural Sales
- Agriscience Fair
- Animal Nutrition
- Food Science and Technology
- Meats Evaluation and Technology
- Poultry Evaluation

Proficiency Awards (FFA)

- Diversified Agricultural Production
- Diversified Livestock Production
- Specialty Animal Production
- Poultry Production
- Veterinary Medicine





CHAPTER 24

Introduction to Poultry Production



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Explain the different types of poultry production.
- Identify and define the two main types of poultry products.
- Identify and explain different types of poultry.



KEY TERMS

vertical
integration
bulk
broiler
layer
table eggs
breed

variety
type
class
rooster/cock
cockerel
capon
pullet

chick
chicken fancier
strain
poult
tom/gobbler
hatchery

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Chicken	Poulet	Huhn	Pollo	El Pollo
Duck	Canard	Ente	Anatra	El Pato
Gander	Jars	Gänserich	Papero	El Ganso
Goose	Oie	Gans	Oca	El Ganso
Hen	Poule	Henne	Gallina	La Gallina
Rooster	Coq	Hahn	Gallo	El Gallo
Turkey	Turquie	Türkei	Tacchino	El Pavo

The poultry industry includes chickens, ducks, turkeys, geese, game birds, and other birds used in agricultural production. The two major products from poultry – eggs and meat – are some of the most widely-used animal products. Although many bird species are important to the agricultural industry, the chicken is by far the most important.

The United States is a major producer and exporter of chicken. Chicken meat and eggs are by far the most consumed poultry products. Because the chicken industry accounts for the majority of the commercial poultry industry, the terms “poultry industry” and “chicken industry” are sometimes used interchangeably, although incorrectly. The poultry industry does not deal only with chicken, as it also includes turkeys, ducks, geese, and all other birds.

The Poultry Industry

The size of a poultry operation ranges from small backyard flocks to large commercial operations. Large commercial operations produce over 99 percent of the poultry products found in grocery stores (Figure 24-1). Poultry products for human consumption include meat, such as broilers, and table eggs.



Courtesy of Chore-Time Systems, Millford, Indiana

FIGURE 24-1

Large commercial poultry farms produce over 99% of all poultry products. Pictured is a commercial layer facility.

vertical integration

when two or more steps in production are owned or controlled by the same company

bulk

purchasing supplies and feed in large quantities, usually at lower prices

The poultry industry is a large and efficient production system. The industry is vertically integrated to a high degree, allowing for much more efficient production than in small flocks. **Vertical integration** is the combination of two or more stages of production into one company rather than having the production stages operated by separate companies. For example, one company may own the hatchery, feed mill, packing plant, and distribution center. An advantage to large companies is that they can buy inputs, such as feed, in **bulk**. This keeps production costs low. Large companies can buy the best technology and carry on research to develop the best genetics for the poultry. Such advances have helped poultry companies to become larger and highly efficient.

Most poultry companies contract with farmers to produce meat and egg products. The companies generally supply the production expertise, chicks, feed, and medication. They may also provide the financing of the operation, thus having control over

all management decisions. The farmer provides the land, housing, labor, day-to-day management, and facility maintenance. The farmer is responsible for taking care of the birds throughout the growing process. Although large companies remain in control of the industry, contract growing agreements have helped the family farm survive.

Commercial Poultry Production

The commercial poultry industry is divided into egg and meat production. In chickens, broilers are used for meat production, and layers are used for egg production. **Broiler** is the term used to describe large-breasted birds used for meat production. **Layers** are birds which are used in commercial chicken operations to produce **table eggs** (Figure 24-2). Table eggs are eggs used for human consumption as compared to hatching eggs. Table eggs are not fertile eggs, which means they will not hatch.

Both meat and layer operations depend on hatcheries for their stock. Hatcheries provide young birds to producers. The hatcheries are supplied with eggs for hatching from independent egg farms or company-owned egg farm operations. The eggs sent to hatcheries must be inspected. They must be fertile and of good quality. Eggs that are damaged or considered to be of a sub-standard quality go into pet food production.

broiler

a large-breasted chicken used for meat production

layer

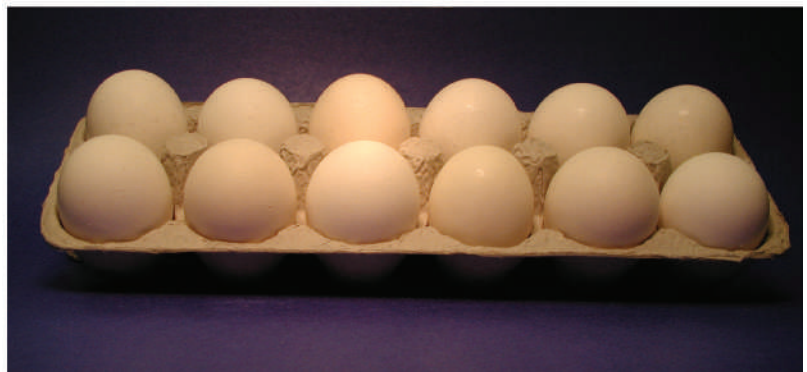
a chicken used for egg production

table eggs

eggs produced for human consumption

FIGURE 24-2

The eggs used for human consumption are called table eggs.



Classification and Uses of Poultry

breed

a group of related animals that show distinctive characteristics and have evolved from common ancestors

variety

a subclassification of a species based on certain traits, such as color of plumage and comb type

type

the purpose for which the poultry will be used

class

refers to the geographic origin of the poultry

Poultry are divided into breeds, varieties, and types. A **breed** is a group of related fowls (birds) that show distinctive characteristics and have evolved from common ancestors. Breeds are subdivided into varieties. A bird's **variety** is based on certain traits, such as color of plumage and comb type. **Type** refers to the purpose for which the poultry will be used. The two general types of poultry are egg-type and meat-type. **Class** generally refers to the geographic origin of the poultry. Four classes generally used for chickens in the United States are Mediterranean, American, English, and Asiatic. The American Poultry Association publishes The American Standard of Perfection, a book that lists and describes more than 300 breeds and varieties of poultry.

Chickens

The first chickens were the Red Jungle Fowl. They originated and were domesticated in Southeast Asia. Until the late 1800s, chickens were raised almost exclusively in small, backyard flocks. Most people produced their own poultry for meat and eggs, or purchased them from their neighbors. Around 1900, the modern poultry industry began to evolve. Because more people were moving into cities, larger growers were needed to supply the demand for poultry meat and eggs. The use of refrigeration, good transportation, and improvement in poultry breeds helped make the development of the modern poultry industry possible.

A mature male chicken is known as a **rooster** or a **cock** (Figure 24-3). A male chicken that is less than one year old is a **cockerel**. A **capon** is a male chicken which has been castrated and raised for meat. A mature female chicken is a **hen**. A **pullet** is an immature female chicken. A baby chicken is called a **chick**.

rooster/cock

mature male chicken; also known as a cock

cockerel

male chicken under a year old

capon

castrated male chicken

hen

mature female fowl such as chickens and turkeys

pullet

immature female chicken

chick

baby chicken

FIGURE 24-3

Roosters or cocks are male chickens. They tend to be larger and have different feathering and combs than hens. A white Leghorn rooster is shown.



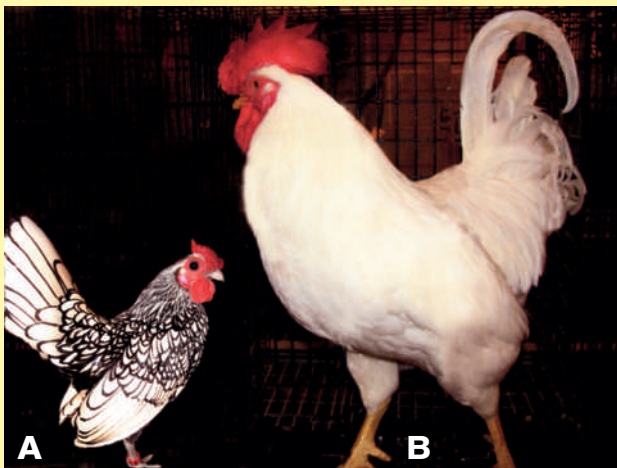
Delmar/Cengage Learning

chicken fancier

someone who raises chickens as a hobby

There are hundreds of breeds and varieties of chickens. Breeds and varieties have differences in their plumage colors, the type of comb, and size. Only a small number of breeds, varieties, and strains play a significant part in commercial poultry production. Other breeds are maintained by **chicken fanciers**, or hobby breeders.

did you know?



Delmar/Cengage Learning

One of the more popular and interesting breeds is the Bantam. Bantams are a small breed of chicken (Figure 24-4). As adults, they do not weigh more than 30 ounces. Bantams are usually shown or kept as pets. Many of these birds are found in home flocks. Because of their small size, they do not require a lot of space.

FIGURE 24-4

Bantam chickens (A) are smaller than standard chicken breeds (B).

**FIGURE 24-5**

Combs are the red fleshy appendage on the top of a chicken's head. There are several different kinds of combs, including the single comb shown here.

The chicken comb is the fleshy, red appendage on the top of the chicken's head (Figure 24-5). The comb is a major characteristic used in the identification of chicken breeds. Some comb types are single, rose, pea, cushion, buttercup, strawberry, and V-shaped. The single comb is the most common type.



History Connection

Scientists believe that birds are descendants of dinosaurs. In 2007, proteins attached to preserved *T. rex* bones provided strong evidence that chickens are the closest living relative to the *Tyrannosaurus rex*. Some scientists go so far as to say that birds are living dinosaurs!

strain

a group of birds that have been bred for specific characteristics

Broilers Most chickens used for broiler production evolved from a cross of three common breeds. Three of the main breeds included in the crosses are the Cornish breed, the Plymouth Rock breed, and the New Hampshire breed. This three-way cross produces a large-bodied, broad-breasted chicken. In commercial operations, strains of birds are used. A **strain** is a group of birds that have been bred for specific characteristics. Each company has their own specialized strain of chicken. The breeding of these strains is highly scientific, and sometimes closely guarded company secrets.

Layers Today, the poultry layer companies use a strain based on the White Leghorn (Figure 24-6). The White Leghorn is used due to its superior egg production. White Leghorns can lay an average of 270 eggs a year. Layers are small, at around 3.5 pounds.



Courtesy of USDA

FIGURE 24-6

White Leghorn hens are typically used in commercial laying facilities. Despite their small size, they can lay around 270 eggs per year.



Math Connection

A laying hen that weighs only 3.5 pounds can lay 270 eggs per year. If all those eggs were large eggs, and a dozen large eggs weighs 24 ounces, how many pounds of eggs can one hen lay in one year? Answer: nearly 34 pounds of eggs a year, almost 10 times the hen's body weight!

Consumers generally prefer white eggs, but some breeds produce brown eggs or other colors. The Barred Plymouth Rock and Rhode Island Red produce brown eggs. They are not as productive as commercially raised birds, and are used more in home flocks. They are a dual purpose breed and can be used for meat or egg production. However, due to low efficiency, they are not used in commercial production. According to scientific research, there is virtually no difference in nutritional value between eggs that have a white shell and eggs that have a colored shell.

Turkeys

Turkeys are native to North America. They were taken back to Europe by the early explorers. Breeds originating from the wild turkey are grown for food all over the world. However, the wild turkey is very different from the modern domestic turkey (Figure 24-7). Commercial turkeys have been developed with very large breasts and are much heavier than wild turkeys. Wild turkeys weigh less than 20 pounds, while a commercial turkey can weigh 50 pounds or more. Commercial turkeys are so large that they cannot fly and cannot breed naturally. They must be artificially inseminated (AI). Development of the broad-breasted turkey was in response to consumer preference for more white meat.

A young turkey is called a **poult**. A mature male turkey is a **tom** or a **gobbler**. A female turkey is a hen. The Broad-Breasted White is the most popular

poult

young turkey

tom/gobbler

mature male turkey; also called a gobbler

FIGURE 24-7

Wild turkeys, shown here, are very different from the modern commercial turkey.



Courtesy of the Fish and Wildlife Service

FIGURE 24-8

The Broad-Breasted White turkey is the most popular commercially produced turkey. Young turkey poults are shown here.



Courtesy of Scott Bauer, USDA

breed in commercial turkey production (Figure 24-8). A number of different varieties of turkeys exist, including the Broad-Breasted Bronze, Beltsville Small White, Narragansett, Black, Slate, and Bourbon Red. Like other poultry, the colors of the feathers have been bred out over time so that commercially raised turkeys of today are almost always white.

The consumption of turkey meat is increasing. Turkey consumption in the U.S. is on the rise because turkey is presently being promoted for year-round consumption. Turkey consumption is also rising because of health concerns over red meat.

The production of further-processed turkey products, such as turkey bologna, turkey bacon, and turkey ham, has enticed consumers to eat more turkey.

The top states for turkey production are Minnesota, North Carolina, Arkansas, Virginia, Missouri, California, and Indiana. Like the chicken industry, most turkeys are produced indoors and in very large flocks.



History Connection

Benjamin Franklin proposed to make the wild turkey the national bird of the United States. However, the Bald Eagle was chosen as the national bird by the Continental Congress in 1782.



History Connection

The turkey got its name through mistaken identity. When the Spanish explorers took the bird back to Europe from the New World, it was confused with a bird from the country of Turkey. The name stuck.

Ducks

There is a wide variety of duck breeds. The White Pekin is the most popular breed for meat production (Figure 24-9). The Pekin is white and grows to a market weight of 7–8 pounds. The production of duck meat is a specialized business. About 60 percent of the Pekin ducks in the United States are raised for meat in Indiana by one company. Ducks are usually raised for meat, but they are sometimes used for egg production as well.

FIGURE 24-9

White Pekin ducks are the most commonly used breed of ducks for meat production.



© Shutterstock/Joca de Jong

Other Poultry

Other types of poultry include guinea fowl and geese. These are mostly raised by small producers and backyard enthusiasts for meat and eggs. They are also sometimes used for farm protection. Both guinea fowl and geese are very protective of their surroundings and will alert the homeowner to invaders and visitors.

Trends in Production and Consumption

The poultry industry has grown rapidly over the past several years. The United States ranks first in broiler production and second in egg production in the world. The U.S. broiler industry is five times larger than it was forty years ago. Most broilers are raised in the southeastern United States. Leading broiler-producing states include Georgia, Arkansas, Alabama, Mississippi, and North Carolina.

The consumption of poultry has dramatically increased. The annual per capita consumption of poultry meat has increased from 40.5 pounds per person in 1970 to around 100.4 pounds per person today. The United States is the world leader in poultry consumption. One reason for the dramatic increase in poultry consumption is the concern about

cholesterol in red meat. Poultry meat has a lower level of cholesterol than other meats, such as beef and pork.

Eggs are produced in every state. The leading states in commercial egg production are Ohio, Iowa, Indiana, Pennsylvania, and California. Consumption of eggs was once decreasing because of a concern for the high cholesterol content of eggs. However, the consumption of eggs has begun to increase in recent years. Eggs are a low-cost source of high-quality protein and other nutrients.

Sources of Chicken and Other Poultry

hatchery

a facility where eggs are hatched under artificial conditions

Hatcheries are facilities where eggs are hatched under artificial conditions. Hatcheries duplicate the conditions under which a hen would incubate her eggs. Proper temperature and humidity must be maintained, and eggs must be turned periodically as the hen would do in the nest. Some hatchers produce a wide variety of birds to sell to small producers and hobbyists. Most poultry companies have their own hatcheries or they purchase chicks from large hatcheries. Hatching eggs come from breeders who raise parent flocks, which must have roosters to provide fertile eggs. Breeders contract with the poultry hatchery or company to produce hatching eggs. Once the chicks are hatched and vaccinated, they are sent to growers for meat or egg production as one-day-old chicks. Chicks can be purchased as sexed chicks or straight-run chicks. Sexed chicks are separated into groups of pullets (females) and cockerels (males). Straight-run chicks are not divided by their sex. The use of the bird will determine which sex to buy. Pullets are used for egg production, while either pullets or cockerels can be used for meat production. In most cases, cockerels are used for meat production since they grow larger and faster than pullets.



Science Connection

Oil and water do not mix. For birds, this is critical. Birds coat their feathers with oil from glands at the base of their tail. The oil is water-repellent, so birds stay dry. When chickens are washed for showing, the oil is removed from the feathers by the soap or shampoo. During cold weather, show chickens have to be kept in a warm place after a bath because their wet feathers can't trap air that will insulate them and keep them warm.

Summary

The poultry industry includes chickens, turkeys, ducks, game birds, geese, and other types of birds. However, in the U.S., almost all meat and eggs on the market are produced from chickens.

The size of a poultry farm can range from small backyard flocks to large commercial operations. Large commercial operations produce over 99 percent of the poultry products that are consumed. Most of the poultry industry is vertically integrated to some degree, highly specialized, and efficient.

The production and consumption of eggs in the United States has increased in recent years. The broiler industry is five times larger than it was 40 years ago. Broiler production is concentrated in the southeastern states, with Georgia and Arkansas generally leading in broiler production. Eggs are produced in every state.

Eggs are hatched in hatcheries, and the chicks are sold to producers at one day of age. Producers use the birds for egg or meat production. The White Leghorn breed is most commonly used as layers for table eggs. Three breeds – the Cornish, Plymouth Rock, and New Hampshire breeds – have been crossed to create a large-bodied, broad-breasted chicken used in commercial broiler production.

Commercial turkeys were derived from the Native American turkey. However, through selective breeding, modern turkeys are quite different from wild turkeys. The per capita consumption of turkey has increased significantly since 1970. Most of the turkeys raised in the United States are large Broad-Breasted Whites.

Duck meat production is a specialized business, with over 60 percent of ducks being produced by one company in the Midwest. The White Pekin is the most common breed used in duck production.

A wide variety of types and breeds of poultry are produced in the U.S. by hobbyists. Commercial poultry production centers mostly around the chicken, but includes turkeys, ducks, and some other birds. Highly selected strains are used in poultry production.

Quick Facts

- Over 99 percent of poultry products found in grocery stores are produced by large commercial operations.
- The poultry industry is vertically integrated.
- The broiler industry has grown rapidly in the past 40 years.
- Chickens descended from the Red Jungle Fowl, which is native to Southeast Asia.
- The modern poultry industry began to evolve around 1900.
- The majority of the poultry industry is centered on chickens used for meat and egg production, although other birds such as ducks, turkeys, and geese are also used in agricultural production.
- The two types of chickens in the poultry industry are broilers and layers.
- The White Leghorn is the most common breed used in strains of chickens bred for egg production.
- A White Leghorn can lay about 270 eggs per year.
- Chicken fanciers, or hobby breeders, maintain hundreds of chicken breeds not used in commercial poultry production.
- The comb of the chicken is a major identifying characteristic for the breed.
- Commercial turkeys must be artificially inseminated for breeding because they are too large to breed naturally.
- The Broad-Breasted White is the most common breed for commercial turkey production.
- Commercial turkeys descended from wild turkeys, but they are quite different in several ways from their ancestors, including weighing almost twice as much.
- Further processed turkey products, including turkey bologna and turkey ham, have increased the demand for turkey.
- The White Pekin is the most popular duck for meat production.
- A hatchery is a facility where chicks are grown and hatched for layers or broilers.

Student Learning Activities

1. Visit a grocery store and prepare a list of products sold there that are made from turkey and chicken, such as turkey bologna.
2. View a video on poultry production, and visit a production facility if possible.
3. Prepare a presentation tracing a hatching egg throughout the poultry production cycle.
4. Compare and contrast layer and broiler production.
5. Hatch eggs in the classroom.

Discussion Questions

1. What is meant by the term vertical integration?
2. Describe the trends in production and consumption of poultry products in the United States.
3. Why is the breeding of strains of chickens used in commercial production usually a company secret?
4. What is the difference between a broiler and a layer?
5. What is the distinction between table eggs and hatching eggs?

Review Questions

True/False

1. Most poultry raised in the United States is produced in large commercial operations.
2. Vertical integration is not currently common in the poultry industry.
3. Hatcheries sell chickens at 8 days old to growers.
4. Broiler production is concentrated mainly in the Northeastern part of the United States.
5. The chicken is the closet living relative to the *T. rex*.

Multiple Choice

1. The _____ is the most commonly used breed of duck for meat production.
 - a. Muscovy
 - b. White Pekin
 - c. Broad-Breasted White
 - d. Silver Appleyard
2. In recent years, the poultry industry has had _____.
 - a. increased growth in both broiler and layer production
 - b. decreased growth in both broiler and layer production
 - c. increased growth in duck production and decreased growth in layer production
 - d. decreased growth in broiler production and increased growth in turkey production
3. Chickens are native to _____.
 - a. Europe
 - b. America
 - c. Asia
 - d. South America
4. Large commercial poultry operations raise over _____ percent of the poultry found in grocery stores.
 - a. 67
 - b. 89
 - c. 97
 - d. 99
5. Although all colors of eggs may be sold, most consumers prefer _____ eggs.
 - a. white
 - b. brown
 - c. speckled
 - d. multi-colored

Completion

1. A young turkey is called a _____.
2. Commercial breeds of turkeys cannot breed naturally and must be _____ to reproduce.
3. The most commonly used turkey breed for meat production is the _____.
4. Chickens used for the production of table eggs are referred to as _____.
5. The fleshy appendage on top of a chicken's head is the _____.

Short Answer

1. What are the four classes generally used for chickens in the U.S.?
2. What was the proposed national bird, prior to the Bald Eagle?
3. What is the purpose of a hatchery?
4. Describe how the turkey got its name.
5. Only a few breeds of poultry are produced commercially. Who maintains the hundreds of other breeds?



CHAPTER 25

Management of Poultry



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe feeding practices for poultry.
- Describe housing types used in commercial poultry operations.
- List parasites and diseases of poultry.
- Explain the science and practical application of the molting process.
- Describe the management of backyard poultry flocks.



KEY TERMS

ad libitum

grit

feed efficiency

battery cage

loose housing

tunnel ventilation

photoperiodic

molting

avian influenza

coccidiosis

coccidiostat

infectious

laryngotracheitis
(LT)

newcastle
disease

arachnid

organic

niche

marketing

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Egg	Oeuf	Ei	Uovo	El Huevo
Feather	Plume	Feder	Piuma	La Pluma
Hatch	Éclorre	Schlüpfen	Covare	Salir del Cascarón
Organic	Organique	Wachstümlich	Organico	Orgánico
Ventilation	Aérage	Lüftung	Aerazione	Ventilación

Feeding Poultry

The largest expense of raising poultry is the cost of feed, which is two-thirds of the cost to produce eggs and meat. Proper feed management is extremely important in the production of meat and eggs. Corn is the number one ingredient in poultry feeds. It is the primary source of carbohydrates and energy for the bird. Soybean meal is another important ingredient in poultry feeds. Soybeans are the number one source of protein. A mixture of vitamins and minerals are added to poultry feed to prepare a complete ration. Calcium is the most important mineral needed. Layers use calcium from their bones and body to produce eggs. Chickens are normally fed **ad libitum**. This means they are given all the feed they will eat. Poultry feeds in commercial operations are formulated to meet all nutritional requirements. Nutritional diseases rarely occur in commercial broilers and layers. Chickens have no teeth, so **grit** is needed in the ration. Grit is usually small particles of granite. Grit is swallowed and stays in the gizzard of the bird (Figure 25-1). This helps the gizzard grind the feed. If the feed consumption of a bird drops, it is often a sign of stress, disease, molting, or other management problems.

Chickens have the highest **feed efficiency**, or feed conversion, compared to all other farm animals. Feed efficiency is the amount of feed needed to gain one unit of production. A chicken's feed efficiency is about 1.9 pounds of feed for one pound of weight gain. This is compared to swine which require about 3 pounds of feed for one pound of gain, and cattle

ad libitum

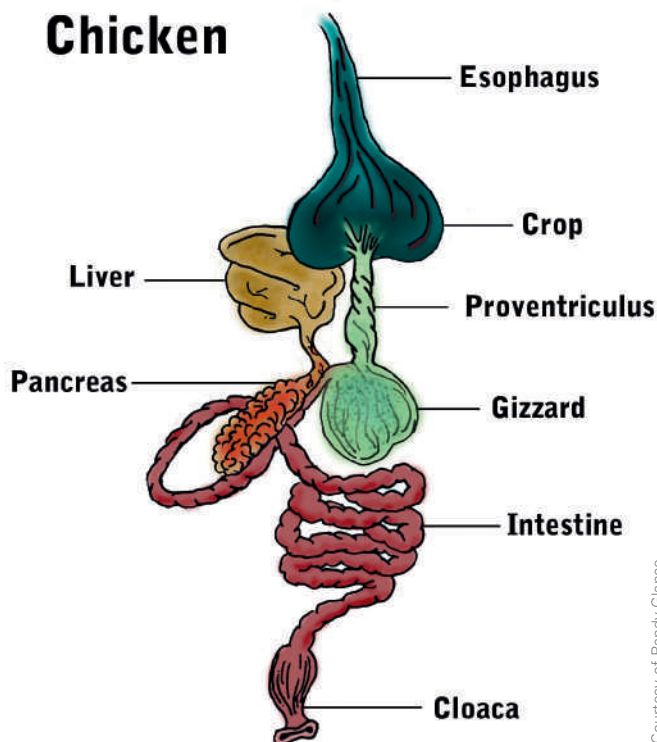
system of feeding livestock in which no limit is placed on feed intake

grit

small particles of granite or other stone used in poultry rations to help in grinding the feed in the gizzard

feed efficiency

the amount of feed needed to gain one unit of production

**FIGURE 25-1**

The digestive tract of a bird.

that require 6.5 pounds of feed for one pound of gain. Layers require two pounds of feed in order to produce one pound of eggs, which is about 7–8 large eggs. These rates are summarized in Table 25-1.

TABLE 25-1

Feed Conversion Ratios

Animal	Pounds of Feed Per Pound of Production
Broiler Chickens	1.9
Eggs	2.0*
Pork	3.0
Beef	6.5

*Pounds of feed required to produce one pound of eggs. All others are pounds of feed required to produce one pound of live weight.



Math Connection

Calculating Feed Efficiency

To determine feed efficiency from birth to harvest, divide the total amount of feed which has been fed by the total weight of the animal.

Example:

Broiler weight: 5.2 pounds

Feed amount: 10.25 pounds

Answer: 1.97 pounds of feed per pound of gain

Managing Poultry

Poultry housing is similar across the country, with modifications for climate. The three major types are the cage system, loose housing, and free-range. Loose housing and the cage system are types of closed housing.

Cage System

The most common housing system for layers is the cage system. More than 90 percent of layer operations use the cage system. Caged layers are generally stair-stacked. The chickens are kept in adequately spaced **battery cages** (Figure 25-2). Multiple birds can be kept in each cage. Battery cages are a source of controversy with animal rights groups. Many feel that battery cages do not permit enough space for birds to perform natural activities. In California, legislation called Proposition 2, The Prevention of Farm Animal Cruelty Act, has been passed concerning the welfare of confining animals in small spaces. It will be against the law for chickens to be kept in battery cages after Jan 1, 2015 in California. Farmers have

battery cage

a type of cage for housing laying hens; cages are grouped together in egg production facilities



Courtesy of Chore-Time Systems, Milford, Indiana

FIGURE 25-2

Battery cages are used for layers.

until then to provide space for egg-laying hens that enables them to stand up fully, lie down, fully extend their wings, and turn around freely. The use of battery cages has already been banned in Switzerland, Belgium, Austria, Germany, Sweden, and the Netherlands, with a full European Union ban set to occur in 2012 after a 10-year phaseout.

Loose Housing

loose housing

a poultry housing method that allows the birds to move freely within a confined building

tunnel ventilation

a method of cooling poultry houses

Broilers are raised in **loose housing**, which means they can move freely within a confined building. Layers may also be housed using the loose housing method. Broiler houses are about 50 feet wide and 500 feet long. Each building can house approximately 22,000 to 25,000 birds. This averages one square foot per bird.

Modern broiler houses use **tunnel ventilation** as a method for cooling. On one end of a house there are fans (Figure 25-3) and on the opposite end of the house there are evaporative cooling pads (Figure 25-4) or cells. The pads are kept wet. With the fans running to blow air out at one end of the house, air is pulled through the pads at the other end and cooled through the process of evaporation. The cooled air is then drawn through the house. Tunnel ventilation allows the birds to be cooled and keeps the house at a stable temperature.



Courtesy of Chore-Time Systems, Milford, Indiana

FIGURE 25-3

Fans pull air through the poultry house for ventilation and cooling.



Courtesy of Chore-Time Systems, Milford, Indiana

FIGURE 25-4

Evaporative cooling pads help to keep poultry houses cool.

Free-Range

Some smaller producers are opting for free-range poultry. These producers allow their chickens or other poultry free access within a fenced area, or let them roam freely over the property. Free-range chickens are used for both meat and eggs. Usually, the producer allows the chickens to graze during the day and encloses them at night for protection. The problems associated with free-range chickens are predators on the ground and in the air, as well as having the time to gather the birds up at night. The free-range system also exposes the birds to parasites and diseases from wild birds.

photoperiodic

sensitive to the length of the day

Closed Housing

Most commercial broiler and layer houses are completely enclosed. Poultry in closed housing are less susceptible to parasites and diseases from wild birds. The house also protects birds from the weather and predators. In closed housing, lighting can be easily controlled. Birds are **photoperiodic**, or sensitive to the length of the day. They respond to the duration of daylight, and are active in light. In broiler houses, the lights are kept low so the birds are not stimulated. Low light also reduces aggression. In layer houses, the lights are kept bright to keep hens laying eggs. In nature, birds lay eggs in the spring and summer when days are long. In a layer house, the extra lighting in fall and winter make it seem like spring and summer to the layers – so they continue to lay eggs.

The trend is for all commercially raised poultry to be produced in closed housing. The structures used for turkeys and other poultry are very similar to those used for chickens.



Science Connection

Birds are able to control their body temperature simply by adjusting or moving their feathers. On cold days, many birds will fluff their feathers. This allows the bird to trap an insulating layer of air in the feathers that is warmed with the bird's body heat. On warm days, the birds will smooth down their feathers, releasing the trapped air. This technique allows birds to adjust to temperature changes. Tiny muscles attached to the sides of the feather follicle are used to raise and lower the feather. This is similar to the erector pili muscle found in the skin of humans that causes goose bumps and raised hair, aiding in temperature control.

molting

the process of shedding feathers and regrowing new feathers

Molting

Molting is the process of a bird losing its feathers and growing new ones. Domestic poultry, as well as wild birds, molt. Wild birds renew their feathers each year for winter protection and sometimes to attract a mate.

During the molting process, a hen will not lay eggs. Commercial poultry producers use a forced molt. The molting process takes about ten weeks. Many producers today do not molt laying hens. Instead, the hens are replaced with new pullets at the end of their first production cycle.

In forced molting, feed is withheld from the hens for up to 10 days. Forced molting has become a controversial issue with animal rights groups due to withholding feed. However, molting is a natural occurrence in birds. Birds in nature go through the same molting process, refusing to eat for a period of time.

Diseases

One of the greatest concerns with poultry is disease prevention. Providing biosecurity, good sanitation, good management, and vaccinations can eliminate the chance for a disease outbreak (Figure 25-5). Diseases can be spread through water, air, feed, other animals, humans, and equipment. Disease can spread rapidly through a poultry house and to neighboring farms. Poultry producers and companies are diligent about protecting their flocks from disease.

FIGURE 25-5

Biosecurity is strictly enforced at facilities such as this broiler stock farm.



Courtesy of Frank Flanders



Courtesy of APHIS

FIGURE 25-6

Poultry influenza causes purple discoloration of the comb. The chicken on the right is infected with avian influenza.

avian influenza

a virus that can cause disease in poultry and humans; also known as bird flu

coccidiosis

a disease caused by various coccidia

coccidiostat

chemicals that are added to feed or water that control protozoans of the order Coccidia

infectious laryngotracheitis (LT)

a virus that attacks the respiratory system of chickens, pheasants, and peafowl

Avian Influenza

Avian influenza, commonly known as the bird flu, is caused by a virus (Figure 25-6). The disease can affect humans. While only a few human deaths worldwide have occurred as a result of avian influenza, it is a major threat to the poultry industry as well as humans. No case of avian influenza has been reported in the United States. The disease can be transmitted through wild birds, rats, air, and water, as well as chickens, ducks, and turkeys. This disease is highly contagious to birds and humans. Some of the symptoms include a fever, loss of energy, cough, sneeze, sore throat, and weight loss. Death can ultimately occur with the disease.

Coccidiosis

Coccidiosis is one of the most costly diseases of the poultry industry. It is caused by a number of different coccidia, which are microscopic, single-celled protozoan parasites. The disease can be spread through feces and infected birds. Symptoms include droopiness, loss of appetite, and bloody diarrhea. The death rate from coccidiosis can be high, and loss of production significant. The best prevention is the feeding of a coccidiostat. A **coccidiostat** is a medication added to feed that reduces the growth and development of coccidia in the digestive tract.

Infectious Laryngotracheitis (ILT or LT)

Infectious Laryngotracheitis (LT) is caused by a virus. This deadly disease attacks the respiratory system (larynx and trachea) and has become a problem for many producers. This virus affects chickens, pheasants, and peafowl. Turkeys, ducks, and geese do not get the disease, but they can be carriers. LT has a very high mortality rate and can devastate an entire poultry operation. Symptoms of LT include

difficulty breathing, coughing, and sneezing. In many cases, birds suffocate because they cannot breathe. Vaccinations are used to prevent LT.

Newcastle Disease

newcastle disease

a highly infectious respiratory
disease of poultry

Newcastle disease is a respiratory disease causing coughing, gasping, paralysis, nasal discharge, and death. The mortality rate can be 90% or more. There are different types of Newcastle disease. In the United States, the disease is referred to as Exotic Newcastle Disease (END). END is highly contagious to any domestic, wild or pet bird and can be carried from place to place by humans. The disease can live in the ground indefinitely. All birds in an infected flock must be destroyed to prevent the spread of the disease. Most poultry are vaccinated for END.

External Parasites

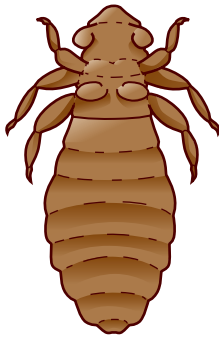
Poultry can be affected by a number of external parasites, including fleas, mites, lice, ticks, and flies. Two of the most serious external parasites of poultry are poultry mites and poultry lice. Proper sanitation practices are necessary to control parasites. Cleaning and disinfecting the poultry house after every group of birds is a recommended practice.

Chicken Mites

arachnid

an eight-legged invertebrate
related to ticks and spiders

Chicken mites are **arachnids** because they have eight legs. The chicken mite feeds on the bird by sucking its blood. Mites normally feed at night. During the day, the chicken mite hides in cracks and crevices in the pen. Infestations of mites can be costly. It is best to treat the poultry facility for mites when the house is empty, and leave the house empty for several days. When a house is unoccupied, the mites are unable to eat and will die of starvation in a few days.



Delmar/Cengage Learning

FIGURE 25-7

Poultry body louse.

Poultry Lice

Poultry lice are small, wingless insects that scratch at a bird's skin for food. The most common louse is the body louse (Figure 25-7). There are several other varieties of louse that attack poultry. Infected birds lose weight, egg production drops, and some birds may die. Infestations can happen at any time throughout the year. The best way to prevent poultry lice is to spray and check birds frequently for lice.

Internal Parasites

Poultry, as most animals, can be infected by many internal parasites. Some of the internal parasites that affect poultry include roundworms and tapeworms. Worms can be spread through droppings. The eggs of the worms are laid in the droppings and picked up by other birds. The eggs then hatch internally, starting the life cycle over again. Worm infestations cause slow growth and lower production in poultry.



Science Connection

Have you ever seen a bird urinate? Probably not. Chickens and other birds do not urinate in the same way as mammals such as cows, pigs, and dogs. The urine of birds is excreted as a thick, cream-colored, non-watery, pasty material. All waste materials from the bird's urinary tract and intestines empty into the cloaca, which leads to the vent. The urine and feces are mixed and excreted together in this semi-solid form.

Backyard Poultry

Backyard or home poultry flocks are small flocks of chickens or other poultry that are raised in small pens or are free-range (Figure 25-8). Free-range chickens are free to roam the property or a portion of the property. They are often caged at night for protection from predators.

FIGURE 25-8

There has been a resurgence of people raising backyard flocks for both fresh eggs and meat.



Courtesy of Frank B. Flanders

organic

a product that is produced without chemicals, chemical fertilizers, pesticides, antibiotics, and other synthetic chemicals

niche marketing

marketing to a specific group of consumers that have special demands for a product or service

The opportunity to market meat and eggs from backyard flocks is increasing due to the organic movement. **Organic** production is defined as the production of a product without the use of commercial chemicals, chemical fertilizers, pesticides, antibiotics, or other synthetic chemicals. Organic poultry must also be fed organic feed in order to qualify as organic. However, free-range poultry are not necessarily organic. Whether caged or free-range, poultry must be produced without chemicals and pesticides to be considered organic.

The increased demand for organic and free-range products has created a niche market for small producers (Figure 25-9). **Niche marketing** is a type of marketing that addresses a certain group of consumers with special demands for a product or service.

FIGURE 25-9

Portable or moveable chicken pens, also called chicken tractors, are an inexpensive way to house small flocks of chickens. Nesting boxes are provided in the enclosed end of the pen.



Courtesy of Frank B. Flanders



Courtesy of Frank B. Flanders

FIGURE 25-10

Free range egg yolks, as shown on the left, are usually darker in color because of the chickens' varied diet.

While there is a demand for organic and free-range products, the cost of production is higher than commercially produced poultry. Most people that purchase or raise free-range or organic poultry products do so because they feel these products are healthier and more natural. When raising birds at home, the owner can control what the birds eat, which has an effect on the color of the egg yolk (Figure 25-10).

Birds raised in backyard flocks molt naturally and will stop laying, or lay very few eggs, in the fall and winter. The shorter days of fall and winter trigger a natural response in backyard flocks as it does in wild birds. Backyard chickens usually go through a more natural process than commercially raised chickens. They will breed in the spring, lay a clutch of eggs, and sit on the eggs to incubate them until they hatch. A clutch of eggs is the number of eggs produced by one bird at any one time, usually in one nest. Hens will lay throughout the spring and summer and hatch one or more clutches of eggs in a season. The chicks may then grow large enough to survive through the winter. In commercial flocks, the light and temperature are controlled to alter the natural molting and reproductive phases of the birds. Also, some of the natural instincts have been bred out of the birds.

Summary

The highest cost of poultry production is feed. The cost of feed is two-thirds of the cost of egg and meat production. Chickens are normally fed *ad libitum*. Chickens have the highest feed efficiency, or feed conversion ratio, of all farm animals.

Broilers and layers are managed differently. Battery cages, commonly used for layers, are a source of controversy among animal rights groups. Broiler chickens, which are raised for meat production, are raised in loose housing. Backyard and small-scale poultry production is becoming more popular. The market for backyard poultry is increasing due to the organic movement. Birds raised in backyard flocks will go through a natural molt and will stop laying eggs in the fall of the year.

One of the greatest concerns with poultry is disease. While internal and external parasites reduce production and are a major annoyance to poultry, many poultry diseases are deadly. Biosecurity, good sanitation practices, and vaccinations help reduce the chance for disease.

Quick Facts

- Feed cost is the greatest expense of raising poultry.
- Grit is needed in feed rations to help the gizzard of chickens grind the feed.
- Chickens have the highest feed efficiency ratio of any farm animal.
- More than 90 percent of layer operations use the battery cage system.
- Commercial chicken houses hold approximately 22,000–25,000 birds, providing approximately one square foot per bird.
- Organic poultry is produced without the use of chemicals or pesticides.
- Birds are photoperiodic, responding to the length of the day.
- Hens will lay eggs naturally throughout the spring and summer.
- Molting is a natural process carried out by all birds.
- Hens kept in a natural setting will molt and stop laying, or lay very few eggs, in the fall and winter.
- Corn and soybeans make up the highest percentage of the ingredients in poultry feed.
- Biosecurity and disease prevention are some of the greatest concerns of poultry producers.
- A number of diseases infect poultry, including avian influenza, Newcastle disease, and coccidiosis.
- Roundworms and tapeworms affect poultry, as well as other livestock.
- Mites and lice are the major external parasites of poultry.
- Backyard poultry flocks are becoming more popular.

Student Learning Activities

1. Investigate and report on instances of major poultry disease outbreaks.
2. Have a poultry producer discuss his or her operation with the class.
3. Visit a backyard poultry operation.
4. Research one internal and one external parasite of poultry.
5. Write a paper on the pros and cons of organic poultry production.

Discussion Questions

1. List the importance and impact that the feed ration and feed efficiency have on poultry production.
2. Describe the differences between broiler houses and laying houses.
3. Explain why many people are opposed to battery cages.
4. List and describe diseases that affect poultry.
5. Explain how diseases and parasites can be prevented in poultry facilities.

Review Questions

True/False

1. Chickens are not sensitive to light and it has no effect on their biological functions.
2. Battery cages are a controversial issue in today's society.
3. Backyard flocks are the most common way of raising poultry.
4. Avian influenza is presently the most costly disease of the U.S. poultry industry.
5. Birds do not urinate in the same way that other animals urinate.

Multiple Choice

1. _____ is the amount of feed needed to gain one unit of production.
 - a. Ad libitum
 - b. Feed efficiency
 - c. Feed ratio
 - d. Efficiency ratio
2. _____ is a type of marketing that is directed at a certain subgroup of people or consumers.
 - a. Mass marketing
 - b. Organic marketing
 - c. Niche marketing
 - d. Commercial marketing

3. Lighting is an important factor in poultry production because _____.
 - a. birds are photoperiodic
 - b. light stimulates poultry
 - c. light affects egg production in layers
 - d. all of the above
4. _____ chickens are raised without pesticides or chemicals.
 - a. Niche
 - b. Conventional
 - c. Mass
 - d. Organic
5. Almost all commercial broilers are raised _____.
 - a. in loose housing
 - b. free-range
 - c. in battery cages
 - d. on the open range

Completion

1. The most expensive single item for raising poultry is the cost of _____.
2. _____ is needed in the ration of birds to help grind food in the gizzard.
3. Compared to other farm animals, _____ have the highest feed efficiency.
4. If the feed efficiency of a group of chickens is 1.9 to 1, then it would take _____ pounds of feed for a chicken to gain 2 pounds in weight.
5. Broiler houses generally use _____ _____ as a method to cool the houses.

Short Answer

1. How does light affect birds?
2. How has the organic movement influenced the poultry industry?
3. Explain why hens that are not used in commercial operations quit laying eggs during the fall and winter.
4. List four different diseases that affect poultry.
5. What is the difference between organic and free-range poultry production?



CHAPTER 26

Poultry and Egg Quality



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Summarize trends in poultry and egg consumption.
- Explain how poultry and eggs are marketed.
- Outline consumer concerns about poultry products.
- Explain the classes of poultry, meat and eggs.
- Judge the quality of poultry, meat and eggs.



KEY TERMS

salmonella
yolk

air cell
egg white

candling
parthenogenesis

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Broiler	Poulet	Brathähnchen	Graticola	El Pollo Tomatero
Flock	Troupeau	Herde	Gregge	El Rebaño
Poultry	Volaille	Geflügel	Pollame	Las Aves de Corral

Trends in Poultry and Egg Consumption

The consumption of chicken, turkey, eggs, and other poultry has increased more than any other livestock product over the past several years. The United States ranks first in poultry production in the world. Also, the United States is the second largest exporter of poultry meat.

Over 50 percent of the poultry that is consumed is further processed. Further processing is the conversion of poultry products into convenient and more readily consumable products like hot dogs, bologna, and chicken nuggets. Today, there are over 3,000 different poultry products available to consumers (Figure 26-1).

The annual per capita consumption of chicken has increased from 25 pounds in 1970 to around 100 pounds of chicken today. Red meat consumption has



Courtesy of USDA

FIGURE 26-1

A wide variety of poultry products are available.

been relatively stable over the years, with beef consumption at 69 pounds and pork at 52 pounds. The change in poultry consumption was brought about by three major factors. First, poultry has become readily available and affordable for most consumers. Second, the convenience of further processed poultry has led to a major increase in consumption. Third, poultry is recognized as being healthier than beef or pork by many people.

While most consumers agree that poultry is not as flavorful as beef, poultry, especially turkey, has the advantage that its meat can be easily flavored and colored. This is a key to making further processed products such as turkey hot dogs, chicken jerky, chicken burgers, and turkey bologna.

Marketing Poultry

Approximately 99 percent of the broilers and most other poultry raised in the United States are grown under contract with large companies. The contract outlines the farmer's responsibilities, payment for the birds, etc. A small portion of poultry is produced by small producers and hobbyists. Poultry grown by small producers is usually directly marketed to consumers or produced for home use.

Turkey has traditionally been identified with Thanksgiving and Christmas. While the holidays are still the time of greatest demand, turkey meat has become a major poultry product that is sold all year long (Figure 26-2). Turkey can be found in a variety of further processed foods, from ground turkey and turkey franks to turkey bacon. Turkey is a delicious and nutritious source of lean protein and is viewed by many as a low cost alternative to red meat. The consumption of turkey has risen from 6 pounds of meat per person in 1970 to 20 pounds per person today.

Eggs are normally produced under contract with a poultry company. More than 90 percent of the eggs produced in the United States are produced under



FIGURE 26-2

Historically, turkey has only been a holiday treat, but today consumers are using turkey and turkey-based products all year long.

contract or are produced directly by an egg company. The popularity of organic and free-range eggs has created a niche market for local and small producers. These products are sold to local businesses or directly to the consumer.

A high percentage of eggs go to breaking plants. Breaking plants remove the shell, pasteurize, and package eggs. Purchasing the eggs in this manner eliminates any danger of salmonella or infectious organisms. Although the risk of salmonella in eggs is extremely low, hospitals and nursing homes want to reduce this risk further by using pasteurized eggs. Elderly people and people with compromised immune systems are especially susceptible, and may die if they contract food poisoning from salmonella.



Technology Connection

HOW DO THEY MAKE TURKEY BACON?

Pork bacon's high fat content is why turkey bacon has become popular as a healthy substitute, since turkey is low in fat. Bacon from pork is taken from the belly and sides of the carcass. Bacon is flavorful, yet fatty. It is known for its streaks of lean and fat. A much less fatty product can be made from turkey.

HOW DO YOU GET BACON FROM A TURKEY?

Turkey meat consists of white meat of the breast and dark meat of the legs and thighs. At the processing plant, the dark meat is ground into a coarse paste and the white meat is ground into a fine paste. The two meat pastes are put into a machine side by side and squeezed out like multicolored toothpaste. The large extrusions of turkey meat paste have alternating stripes of white and dark meat that are pressed together. During the cooking process, the white and dark meat stripes bond together to make one solid piece. The turkey bacon is then sliced into bacon-sized strips, and packaged for sale.



Social Studies Connection

CHICKEN FEET

Forget the popcorn! In China, chicken feet are popular as a movie snack rather than popcorn. They are considered a delicacy in that country. Chicken feet or chicken paws have a high fat content without much meat. Meanwhile, U.S. chicken farmers are cashing in by exporting chicken feet to China. Once a worthless by-product, chicken paws or feet have become a major U.S. export (see Figure 26-3).



©iStock/Elzbieta Sekowska

FIGURE 26-3

In some parts of the world, chicken feet are served as a snack. This once worthless product is now a valuable export.

Consumer Concerns about Poultry

Many consumers have concerns about the production and processing of poultry relating to the safety of poultry products. One of the common public misconceptions is that producers feed hormones to poultry (Figure 26-4). Hormones are not used in poultry production; in fact, it is illegal in the United States. In addition, there is no advantage to adding hormones to chicken feed. The poultry industry is working to change the idea that hormones and steroids are used in poultry production.

Salmonella is a major concern for consumers as well as producers. Salmonella is a type of bacteria that can cause food poisoning. Salmonella food poisoning can be prevented by cooking and handling meat and eggs properly. Salmonella bacteria may

salmonella

a bacteria that can cause food poisoning

FIGURE 26-4

It is illegal to use hormones in poultry production. In addition, there is no advantage to adding hormones to chicken feed.



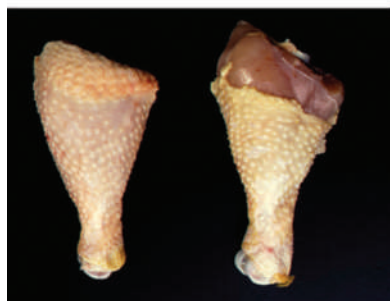
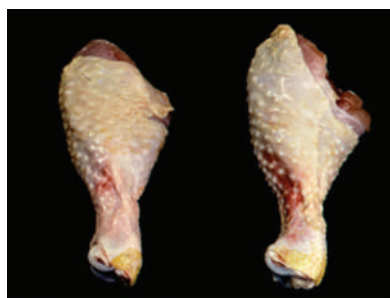
reside in uncooked chicken and eggs. Good sanitation practices include keeping uncooked poultry separate from cooked poultry and other foods. Separate cutting boards should be used for raw meat and all other foods.

Classes of Ready-to-Cook Poultry

The USDA sets standards for classes of ready-to-cook chickens, turkeys, pigeons, ducks, guineas, and geese. The chicken classes are: Cornish game hen, broiler, roaster, capon, hen, and cock or rooster. The most important class is the broiler class. Almost all chicken sold in grocery stores are broilers. Broilers are young chickens of either sex, usually about six weeks of age. They have tender meat with soft, pliable, smooth-textured skin and flexible breastbone cartilage.

Grades of Ready-to-Cook Poultry

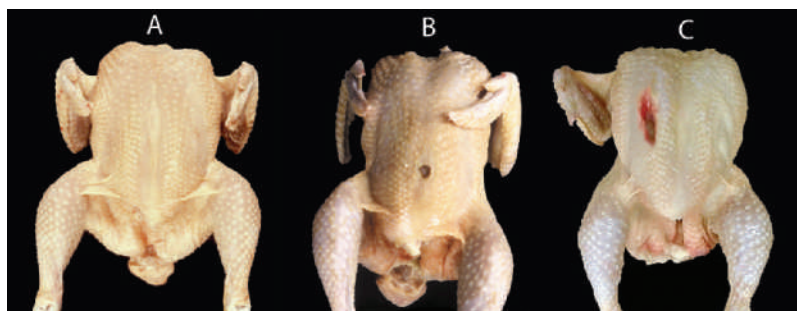
All poultry sold for human consumption in the United States must be processed, handled, packaged, and labeled in accordance with federal laws. Poultry must be inspected by the United States Department of



Courtesy of USDA

FIGURE 26-6

Grades A and B chicken legs. All legs on the left are Grade A. All legs on the right are Grade B. TOP PAIR: Grade B due to discoloration. Grade A on the left has some discoloration but within tolerance. MIDDLE PAIR: The right leg is Grade B because it has too much flesh exposed. BOTTOM PAIR: The right leg has too much flesh exposed which makes it Grade B. The leg on the left has a small tear in the skin, but it is too small to be considered a defect.



Courtesy of USDA

FIGURE 26-5

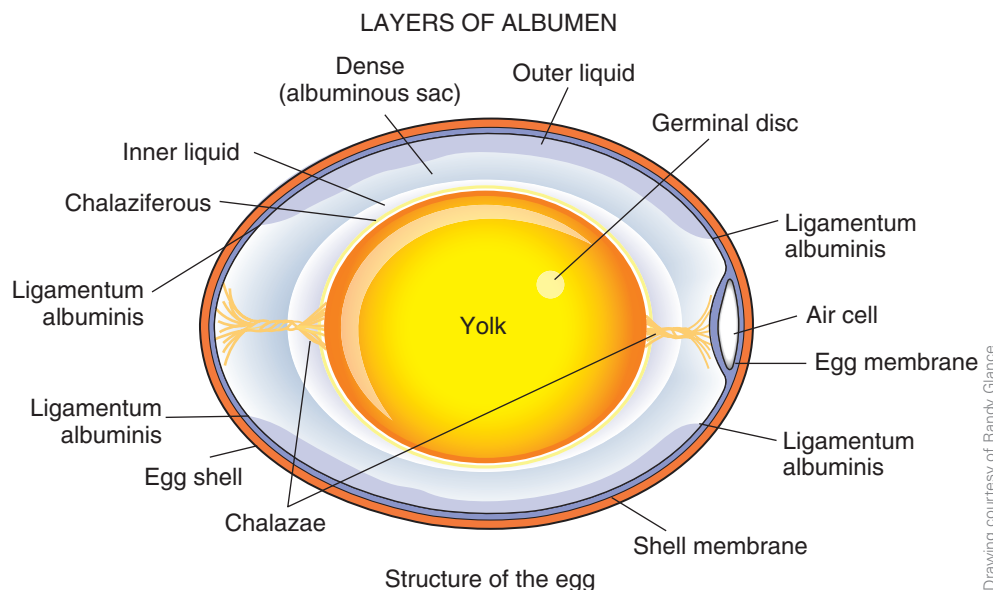
Chicken carcasses, Grades A, B, and C. The carcass in the middle has exposed flesh greater than 1/4 inch. Grade C, on the right, has an entire wing missing and discoloration greater than 2 inches that is more than moderate in color.

Agriculture (USDA). Quality grading of poultry is not mandatory, but most poultry processors have their products quality graded voluntarily. The USDA quality grades of poultry are grades A, B, and C. Poultry grades are applied to whole birds and parts, including poultry halves, breasts, legs, thighs, drumsticks, wings, and tenderloins. The standards for grading ready-to-cook poultry are found in the USDA Poultry Grading Manual. These standards apply to all types of poultry.

The quality grade is determined by the following factors: conformation, fleshing, fat covering, defeathering, exposed flesh, discolorations, disjointed and broken bones, and freezing defects. Grade A is the only grade of poultry that is generally sold at retail. Grades B and C are used in further processed poultry products. Grade A poultry has little to no defects. Grade A poultry is allowed to have a minimum amount of cuts or tears in the skin. If defects exceed the amount permitted, the quality is dropped to the next grade (Figures 26-5 and 26-6).

Eggs

Eggs for human consumption are called table eggs to distinguish them from fertile eggs that are used for hatching. While fertile eggs may be eaten, almost all eggs sold in grocery stores are produced in layer

**FIGURE 26-7**

Parts of an egg.

yolk

the yellow part of the egg that provides nutrients to the developing embryo in a fertilized egg

air cell

air pocket found at the top of an egg

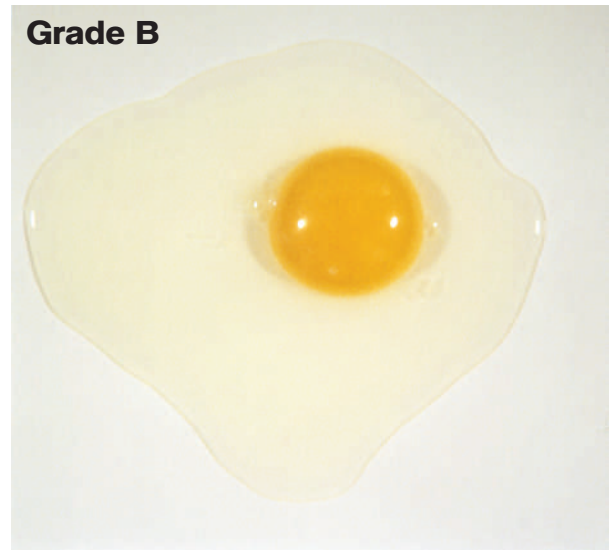
egg white

the substance that surrounds the egg yolk

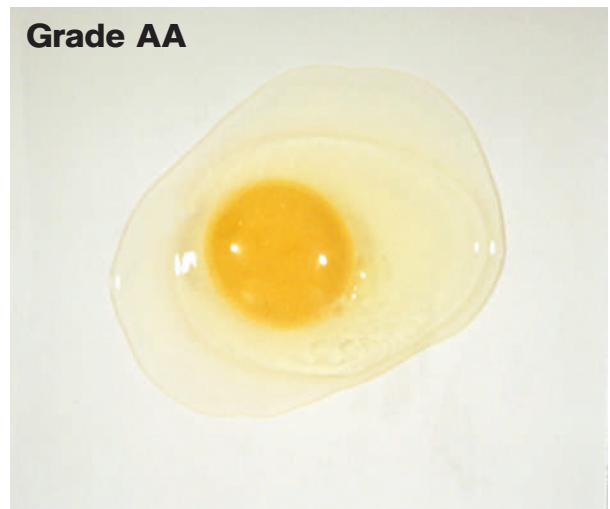
operations where there are no roosters. These eggs, of course, are not fertile. An egg is a large single cell which has pores in the shell for air exchange. The different parts of the egg can be seen in Figure 26-7. The germinal disc of a fertile egg develops into an embryo. The **yolk** is the main source of nutrition for the developing embryo. The yolk is the yellow-orange spherical portion of an egg.

Classes, Grades, and Egg Quality

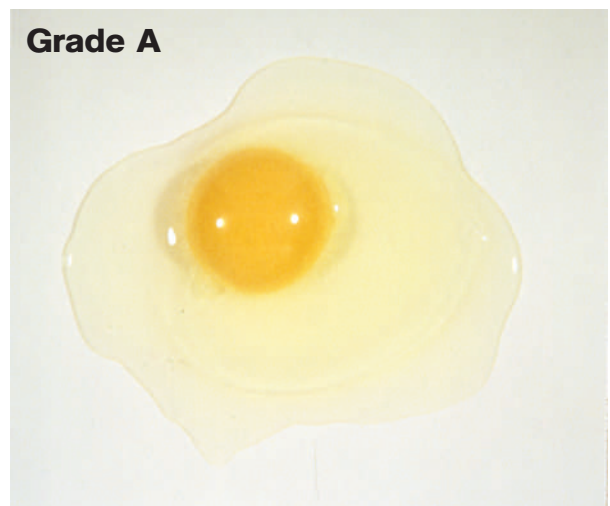
The USDA grades of eggs are AA, A, and B. When determining the grade of an egg, four parts are evaluated: the shell, air cell, yolk, and white. The **air cell** is an air pocket found at the top of the egg (the widest end). The older the egg, the larger the air cell becomes. AA grade eggs are the freshest. The yolk will stand high and hold its shape in Grade AA eggs. As the eggs age, the yolk slowly flattens. The **egg white** surrounds the egg yolk. The white will stand high and close to the yolk in AA eggs, and will spread away from the yolk as the egg ages. The differences in egg grades can be seen in Figures 26-8 through 26-10. The USDA Standards for grades of eggs does not take into consideration the color of an eggshell

**FIGURE 26-8**

Grade B egg, top and side view. All freshly laid eggs are Grade AA, but they deteriorate over time to Grade B. Grade B eggs are usually used in food processing.

**FIGURE 26-9**

Grade AA eggs are the freshest and best quality eggs. Grades AA and A are sold in grocery stores.

**FIGURE 26-10**

Grade A eggs are of high quality.

when determining the egg quality. The color of the eggshell does not affect the egg's nutritional value, although many consumers prefer a particular color egg over others.



Science Connection

The color of the eggs a chicken will lay can usually be determined by looking at the color of the chicken's earlobes. A hen with white earlobes and white feathers will usually lay white eggs. Hens with dark feathers and dark earlobes will usually lay brown eggs.



Physical Science Connection

Eggs can withstand a lot of pressure if applied in the right direction. Eggs are well-designed. The ends of an egg are arches, one of the strongest architectural designs. Many ancient bridges and buildings are still standing because of the strength of their arches. This is why eggs are placed in the carton standing on end. It is difficult to crack an egg if pressure is placed on the ends of an egg (Figure 26-11).



Delmar/Cengage Learning

FIGURE 26-11

Eggs are shipped standing on end. An eggshell can support a surprising amount of weight when the weight is applied end-to-end. The arch shape of the top and bottom of the eggshell distributes pressure evenly over the shell. The sides of the eggshell are much weaker.

candling

use of a high-intensity light to determine the interior quality of an egg

A process called **candling** is used to determine the interior quality of eggs. Candling is a process using high-intensity light to examine the inside of an egg. Eggs are candled to show the size of the air cell and defects such as blood spots, also called meat spots, which are tiny red spots on the egg yolk.

FIGURE 26-12

U.S. weight classes for eggs.
Minimum weight per dozen eggs.



Courtesy of Delmar/Cengage

Eggs are also divided into weight classes. The classes are based on the ounces per dozen. The weight classes of eggs are shown in Figure 26-12.

Eggs are perishable and can lose quality rapidly if not handled properly. Egg quality is best preserved by keeping the eggs cool after they are processed, and until they are used. Eggs can age more in one day at room temperature (70°F) than in one week in the refrigerator (36°F). Keeping them in the refrigerator slows the degradation process and prolongs their lifespan.



Science Connection

parthenogenesis

the ability of an egg to hatch
without being fertilized by a male

Turkeys have been known to exhibit **parthenogenesis**. Parthenogenesis is the ability of an egg to hatch without being fertilized by the male. Parthenogenesis is rare, and much of the time the embryos do not survive.



Social Studies Connection

Eggs are a timeless favorite of Americans, whether they are boiled, scrambled, fried, or over easy. But how did we get so many ways to prepare eggs? We can thank the French. The French have found 685 different ways to prepare eggs! How many ways can you name?

Summary

The consumption of chicken, turkey, eggs, and other poultry has increased over the past several years. The United States ranks first in poultry production in the world. Chicken meat and eggs are by far the most popular poultry products produced. Over 50 percent of poultry consumed is further processed poultry. Further processing is the conversion of poultry products to convenient and more readily consumable products. Today, there are over 3,000 different poultry products available to consumers.

Approximately 99 percent of the broilers raised in the United States are grown under contract with large companies, and 90 percent of egg production occurs at either company-owned operations or at farms under contract. Small poultry producers sell mostly to local retailers or directly to consumers. Recent demand for organic and free-range poultry has created a market for small producers.

Many consumers have concerns about the production and processing of poultry products. One of the common public misconceptions is that producers feed hormones to poultry. Hormone use in poultry is illegal in the United States. In addition, there is no advantage for the producer to add hormones to chicken feed.

The USDA quality grades of poultry meat are grades A, B, and C. All poultry used for human consumption in the United States must be processed, handled, packaged, and labeled in accordance with federal laws.

The USDA grades of eggs are AA, A, or B. When determining the grade of an egg, four parts are evaluated: the shell, air cell, yolk, and white. The color of the eggshell does not affect the egg's nutritional value, although some consumers prefer a particular color egg.

A high percentage of eggs go to breaking plants where they are separated from their shells, pasteurized, and packaged for sale. Purchasing the eggs in this manner eliminates any danger of salmonella or other contaminants. Eggs with internal defects such as blood spots are eliminated during the candling process.

Quick Facts

- The U.S. ranks number one in poultry production and second in poultry exports.
- Over 50 percent of poultry that is consumed is further processed.
- Three major factors have contributed to the rapid increase in poultry consumption: affordability, further processed products, and health concerns.
- Almost all of the broilers (99%) in the U.S. are raised under contract.
- Turkey, once sold almost exclusively during Thanksgiving and Christmas, is now in demand year round.
- The USDA sets standards for poultry products, including eggs and meat from chickens, turkeys, ducks, and geese.
- Eggs that are used for consumption are known as table eggs.
- The USDA grades of eggs are AA, A, and B.
- The color of the eggshell does not affect the nutritional value of the egg.
- A process called candling is used to determine the interior quality of eggs.
- Eggs must be kept refrigerated to remain fresh and not spoil for the maximum period of time.
- Fertile eggs may be eaten or used for hatching.

Student Learning Activities

1. Prepare a display of eggs showing the different colors, grades, and weight classes.
2. Ask poultry producers to speak to the class about their poultry operation.
3. Ask an agricultural extension agent to speak to the class on poultry products.
4. Prepare a bulletin board display of poultry products.
5. Demonstrate how to cook eggs, using at least four methods.

Discussion Questions

1. What have been the recent trends in the consumption of chicken and other poultry?
2. Discuss the factors used for quality grading of ready-to-cook poultry.
3. Describe the effect that further processing has had on the poultry industry.
4. Briefly describe the USDA quality standards for eggs.
5. Why is poultry meat used for so many further processed products like turkey bacon?

Review Questions

True/False

1. The quantity of broiler meat produced in the U.S. has been steadily decreasing in recent years.
2. Approximately 99 percent of the broilers raised in the United States are grown under contract.
3. Eggs are perishable and must be stored under refrigeration.
4. A breaking plant removes eggshells.
5. Chicken feet are popular as a snack in China.

Multiple Choice

1. The long-term trend in the production of broilers and turkeys has been _____ consumption.
 - a. unchanged
 - b. increased
 - c. decreased
 - d. cyclic
2. Classes of eggs are based on weight that is shown as _____ per dozen.
 - a. ounces
 - b. pounds
 - c. kilograms
 - d. number

3. U.S. egg weight classes include jumbo, extra large, large, _____, small, and peewee.
 - a. intermediate
 - b. standard
 - c. medium
 - d. moderate
4. The strength of an egg, standing on end, is due to its _____.
 - a. thick shell in the middle
 - b. arch-shaped ends
 - c. yolk size
 - d. air cell size
5. Table eggs are _____ eggs.
 - a. fertilized
 - b. unfertilized
 - c. pasteurized
 - d. homogenized

Completion

1. The _____ ranks number one in production and second in the export of chicken products.
2. The color of the eggshell does not affect the egg's _____ value.
3. Use _____ eggs for hatching.
4. Eggs for human consumption are called _____.
5. Grade _____ poultry is the only grade of poultry meat that is generally sold at retail.

Short Answer

1. What are some consumer issues associated with poultry?
2. List three USDA grades for poultry.
3. List four quality factors used to determine the grade of eggs.
4. What is the difference between a table egg and an egg used for hatching?
5. What are egg breaking plants?



Section 9

DAIRY CATTLE

CHAPTER 27 Introduction to Dairy Cattle

CHAPTER 28 Management of Dairy Cattle

CHAPTER 29 Selecting and Judging Dairy Cattle

CHAPTER 30 Fitting and Showing Dairy Cattle

FFA AND 4-H CONNECTION



The following is a partial list of activities in which a student may participate using knowledge obtained in the Dairy Cattle chapters. Students should consult local and state youth organizations, such as the National FFA Organization and 4-H, to determine dairy-related programs available in their area.

- Agricultural Marketing
- Agricultural Sales
- Agriscience Fair
- Animal Nutrition
- Dairy Cattle Evaluation
- Dairy Cattle Handlers' Activity
- Dairy Foods
- Food Science and Technology

Proficiency Awards (FFA)

- Dairy Production
- Diversified Agricultural Production
- Diversified Livestock Production
- Food Science and Technology
- Veterinary Medicine





CHAPTER 27

Introduction to Dairy Cattle



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe characteristics of the dairy industry.
- Discuss trends in dairy farming and production.
- Outline the development of the modern dairy industry.
- Trace the production of milk in the cow's body.
- Define the characteristics and uses of milk.
- Identify and describe the breeds of dairy cattle.



KEY TERMS

udder
alveoli
gland cistern
pasteurization

homogenization
Grade A milk
Grade B milk
fluid milk

somatic cells
carotene
switch

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Dairy	Laitiers	Molkerei	Latteria	Lácteo
Heifer	Génisse	Färse	Giovenca	La Vaquilla
Milk	Lait	Milch	Latte	La Leche
Ice Cream	Crème glacée	Eiscreme	Gelato	El Helado
Butter	Buerre	Butter	Burro	La Mantequilla
Cream	Crème	Crema	Crema	La Crema

Introduction to the Dairy Industry

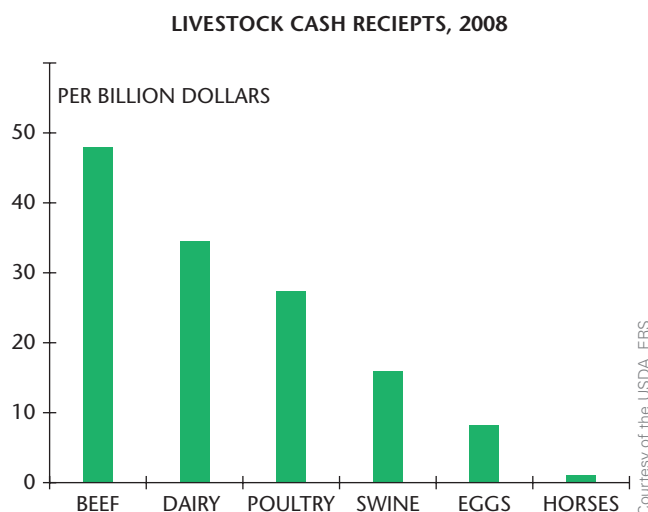
Dairy cows are sometimes referred to as the foster mothers of the human race because they provide us with most of the milk that people drink. All mammals produce milk for their young. Many mammals, such as the dairy cow, milk goat, and water buffalo, produce much more milk than is required for their offspring. The dairy cow produces 85% of the world's milk, with the water buffalo producing 10%, goats 2%, and the rest coming from other animals sometimes used for dairy including sheep, camels, and yaks. The U.S. dairy industry is almost exclusively cattle.

Due to highly intensive management, the dairy industry has led most other agricultural enterprises in the use of technology, artificial insemination, production, and general health. The dairy industry has been a relatively stable industry since the Agricultural Stabilization Act of 1937. This act protects the dairy industry and consumers from greatly fluctuating market prices through a complicated system of governmental milk orders. Dairy products rank third, behind meat and poultry (including eggs), among agricultural industries in total annual sales (Figure 27-1).

Milk has been called by some nature's most nearly perfect food. Although milk is about 85% water, the other 15% is loaded with proteins,

FIGURE 27-1

Cash receipts from livestock and poultry.



calcium, minerals, and vitamins. Proteins help the body to produce muscle and provide energy. Calcium has been proven to aid in the fight against belly fat. The best sources of calcium are milk, yogurt, and cheese. About 72% of the calcium in the U.S. food supply comes from dairy foods. Dairy products include fluid milk, cheese, butter, cream, yogurt, frozen products, and dry milk products such as dry milk and dry whey.

Characteristics of the Dairy Industry

The dairy industry has had tremendous improvements in production in the last 50 years. Milk production has gone from an average of 645 gallons of milk per cow per year in 1953, to an average of 2160 gallons of milk per cow today. This is due to a number of factors, including genetic improvement and effective management. Because of improved genetics, cows born in each subsequent year will be able to produce 30 additional gallons of milk per year than cows born the year before.

One of the key factors contributing to the success of the dairy industry has been good record keeping. Dairy farmers have been some of the best record keepers in agriculture. They keep detailed records on



Courtesy of CST Industries, Harvestore

FIGURE 27-2

Dairy herds between 50 and 99 head account for 30% of dairy farms, but only 14% of milk production. Dairy farms over 2000 head account for 1% of farms, but 23% of the milk produced.



Courtesy of Shannon R. Lawrence

FIGURE 27-3

Although the number of producing dairy cows has decreased in recent years, the total production of milk has increased, due to a significant increase in production per cow.

breeding, genetic information, feeding, health, and milk production. Good records help dairy farmers improve production practices and select the most productive cows for the herd.

Farm Numbers and Size

Over the last few decades, the number of dairy farms has declined, while the number of cows per farm has steadily increased (Figure 27-2). The total number of dairy cows in the U.S. has declined, but the total production of milk continues to increase. In 1954, the average size of a dairy farm was 10 cows, but today the average size is 94 cows per farm. This is due to the introduction of automated milking machines and other labor-saving technology. Before mechanization, a farmer was capable of milking 6–8 cows in an hour by hand. With the help of machines, farmers can milk many more cows per hour. The largest category of dairy farms has between 50 and 99 head of cattle. Most of these farms are family-operated. This category of dairy farms accounts for 14% of the total milk produced in the U.S. Large dairy farms with over 2000 head account for only 1% of the total number of dairy farms, but they provide 23% of the total milk produced in the U.S.

Total U.S. Production

Despite the decrease in the number of dairy cattle, total milk production in the United States has increased within the past few decades, due to an increase in milk production per cow (Figure 27-3). Milk production per cow has increased mostly because of improved genetics.

Dairy cows are found in every state in the United States. The leading states in dairy cow numbers are California, Wisconsin, New York, Pennsylvania, and Minnesota. California is the top dairy production state, and Wisconsin is the second highest dairy production state.

udder

the mammary gland of the cow

alveoli

the structures in the udder that convert nutrients into milk

gland cistern

the storage structure of the udder, just above each teat, that collects milk from the large milk ducts



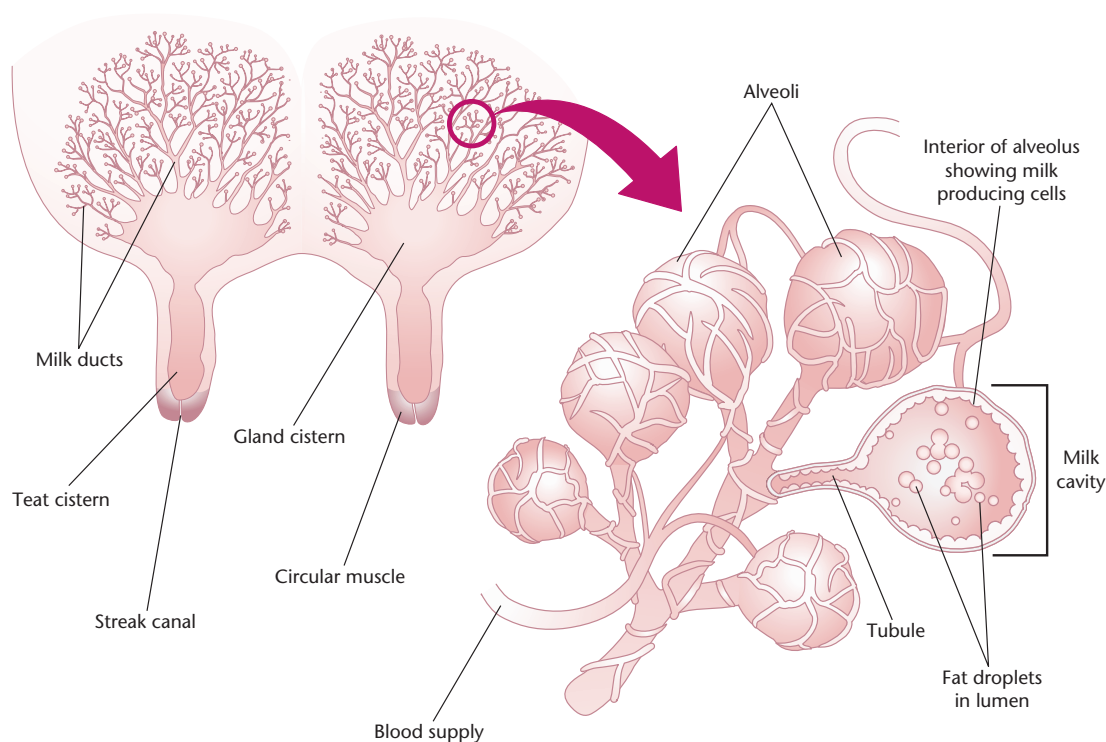
Courtesy of Catrina Kennedy and Scott Register

FIGURE 27-4

The udder is made up of four sections or quarters – two in the front and two in the back. Each quarter has one teat.

The Science of Milk Production

Milk is produced in the cow's mammary gland, or the **udder** (Figure 27-4). The udder is the most important part of a dairy cow because it is where milk production occurs. Tiny structures within the udder called **alveoli** manufacture milk (Figure 27-5). The alveoli receive nutrients from the blood and convert these nutrients into milk. From the alveoli, the milk moves to large milk ducts. The large milk ducts empty into the **gland cistern**. The gland cistern is a storage area for collecting milk from the large milk ducts. The cow's udder is made up of four separate mammary glands called quarters. Each quarter has a teat that provides an outlet for the milk. Milk passes from the gland cistern and out of the udder through the teat.

**FIGURE 27-5**

A side view of a cow's udder showing detail of the alveoli and other udder tissues.

History of Milk Marketing

Until about 1900, milk was a product produced in small quantities, primarily for home use with some local sales. Most families had at least one milk cow, especially in rural areas, for their own personal supply. Limited refrigeration and transportation restricted milk sales to the local area. Inventions such as commercial milk bottles, milking machines, pasteurization equipment, and automatic bottling machines helped make milk a viable commercial commodity. However, the two most important factors that influenced the development of the modern dairy industry were the refrigerated railroad car, and other rapid and dependable transportation methods.

Several technologies in the mid 1800s to early 1900s came together to make the modern milk industry possible. Refrigerated rail cars became available in the 1840s.

In 1856, Gail Borden patented a method for making condensed milk. Borden's method removed much of the water in the milk so that it could be stored in a smaller volume. Borden began canning condensed milk in 1861. During the War Between the States, his canned condensed milk was used by Union troops. After the War, the popularity of condensed milk was spread across the country by the troops returning home.

Glass milk bottles were invented in 1884. Until the mid 1960s, milkmen, who would leave fresh milk by the door in glass containers each morning, were a common part of American life. Waxed paper cartons soon replaced glass containers.



Technology Connection

Victor Farris was the inventor of the paper milk carton. In 1932, plastic-coated paper milk cartons were introduced commercially. In 1964, the all plastic milk container was commercially introduced.

pasteurization

the process of heating milk to high temperatures to kill bacteria

Milk **pasteurization** was invented in 1865 to combat food poisoning and other illnesses related to the lack of refrigeration and preservation techniques. Pasteurization is the process of heating milk to a high temperature, about 160°F for 15 seconds, to kill bacteria.

**Science Connection**

Ultra-pasteurized milk generally stays fresher for a longer period of time because more of the bacteria in the milk are killed than in normal pasteurization. Ultra-pasteurized milk is heated to 280°F for at least 2 seconds to sterilize it, as compared to the normal pasteurization process of 160°F for 15 seconds. Milk that is ultra-pasteurized may have a slightly different taste than normally pasteurized milk, because the high heat can change the taste and smell of the milk. People should do their own “taste test” to see which kind of milk they prefer.

homogenization

the process of breaking the fat globules found in milk into smaller sizes so that the cream doesn't separate from the milk

Homogenized milk premiered successfully in 1919. **Homogenization** is the process of using high pressure to break the fat globules into smaller sizes so that the cream does not separate from the milk. Before homogenization, milk that was allowed to sit undisturbed for several hours separated into two layers – a small top layer of cream (fat globules) that floated on a large bottom layer of milk. The cream was skimmed off and made into butter. At today's processing plants, milk is first homogenized, then pasteurized.

**Language Arts Connection**

An idiom is an expression that means something other than the literal meaning. For example, “The cream always rises to the top” is used to indicate that someone or something is exceptionally good and will eventually be recognized and stand out from the rest.



Courtesy of the USDA

FIGURE 27-6

The Food and Drug Administration (FDA) sets standards for milk products.



History Connection

Louis Pasteur was a French chemist and bacteriologist. In 1856, Dr. Pasteur discovered that heat would kill the bacteria in milk. Today, we continue to use the process of pasteurization, named after its inventor, to make milk safe to drink.

Characteristics of Milk

Not all milk from every cow is the same. Depending on the weather conditions, feed available, feed eaten, water quality, and other conditions, a cow's milk can change from day-to-day. Milk is one of the most regulated foods on the market today. It is inspected numerous times before reaching the consumer to prevent contamination and off-flavors.

Grades of Milk

Milk is certified as Grade A or Grade B (Figure 27-6). These products must be produced, transported, processed, sampled, tested for quality, and labeled in accordance with Food & Drug Administration (FDA) regulations.

Dairies that follow sanitation regulations set forth by the FDA are allowed to sell their milk as **Grade A milk**. It is a higher quality milk that has been produced under more sanitary conditions. **Grade B milk**, although regulated, is not produced under the same strict standards as Grade A milk. Grade B milk is only used for making cheese and other dairy products. Of all the milk produced in the United States, 95% is Grade A.

Grade A milk

milk produced under the strictest FDA sanitation regulations

Grade B milk

milk used in making cheese and other dairy products; production standards are not as high

fluid milk

milk or milk products in liquid form intended for drinking purposes

did you know?

Grade A milk can be used for any purpose – drinking, ice cream, cheese, etc. However, Grade B milk cannot be used for **fluid milk**. Fluid milk is liquid milk or liquid milk products for drinking purposes.

somatic cells

cells from the body such as white blood cells and cells from the mammary tissue

Milk Safety Milk is one of the most highly regulated of all foods. It is tested many times before reaching the consumer. Milk is tested for five major contaminants. These include bacteria, **somatic cells**, antibiotics, sediment (trash), and water content. Somatic cells are cells from the body. White blood cells and mammary tissue cells are sometimes found in milk. This can either mean that the cow has an infection or that the udder has been harmed in some way (i.e., kicking, mastitis, etc.). If too many of these contaminants are found in the milk, then the dairy that owns the cows may not be able to sell its milk.

Demand for Dairy Products

Over 600 pounds, about 69 gallons, of milk and milk products are consumed per person per year in the U.S. This includes the milk used to make cheese and other milk-based products. There are three basic categories of milk usage. About one-third is used as fluid milk, one-third is made into cheese, and one-third is made into butter, yogurt, and frozen dairy products.

Fluid Milk The average American drinks about 22 gallons of milk each year, and 99% of all U.S. households buy milk (Figure 27-7). Fluid milk is mainly



Courtesy of the USDA

FIGURE 27-7

After milk is removed from the milking parlor, it is stored in a refrigerated tank until it is picked up by milk tanker trucks. These trucks deliver the milk to processing plants.

categorized by the amount of butterfat (milk fat) it contains. Fluid milk products are whole milk (3.25 percent milk fat), reduced fat milk (2.0 percent milk fat), and fat-free (skim milk). Whole milk is about 87% water, 5% lactose (milk sugar), and 8% protein, fat, vitamins, and minerals. One gallon of milk weighs 8.65 pounds, while water weighs 8.34 pounds per gallon. Milk is measured and sold to the processing plants by the hundred weight or (CWT).



Math Connection

UNDERSTANDING CWT

CWT is an abbreviation for hundred weight that is often used but rarely understood. Hundred weight is a unit of weight commonly used for agricultural products, including milk. CWT stands for 100 pounds. CWT was first used in England in the medieval era. The hundred weight (CWT) slowly made its way to the United States. The hundred weight (CWT) abbreviation includes the Roman numeral 'C,' which is equal to 100, and WT for weight.

In the early years of dairy industry development, producers noticed that milk contained a small amount of Vitamin D, but it was not enough to meet the recommended daily requirement. Milk producers wanted milk to have a higher nutritional value, so they have been fortifying their milk with Vitamin D since the 1940s. Vitamin D is essential in the absorption of calcium and phosphorus. Rickets may develop if a person is deficient in Vitamin D. It is a disorder in which bones do not calcify completely and are soft. Bow legs typically result in a child because the leg bones have not grown correctly and are distorted. Rickets has been rare in the U.S. since producers began fortifying milk with Vitamin D. Vitamin D can also reduce the chance of developing osteoporosis. The human body can synthesize Vitamin D if exposed to the sun, but very few foods actually contain Vitamin D.



Courtesy of the USDA

FIGURE 27-8

These are the curds used in the process of making cheese.

did you know?

Milk remains fresh for 7–10 days after the expiration date if refrigerated at 35–40°F. Each 5°F rise in temperature shortens milk's shelf life by 50% because of bacterial growth. Pasteurization does not kill all bacteria in the milk, so the warmer the milk, the faster the remaining bacteria grow. Leaving milk at room temperature allows bacteria to grow rapidly, decreasing its shelf life.

Cheese Many types of cheeses are produced from milk (Figure 27-8). About one-third of the milk produced in the United States is used for making cheese. Making one pound of cheese takes 10 pounds (almost 5 quarts) of milk. The most commonly produced cheeses in the United States are cheddar, mozzarella, and American. Mozzarella cheese is the most produced cheese, and is consumed in the highest quantity in the United States because of its popularity on pizza.

did you know?

Cheese is made using an enzyme called rennin. It was originally taken from the stomach of a calf. Calves can drink large amounts of milk without digestive problems because the rennin causes the milk to form curds in their stomachs, making it more like a solid food. When added to milk, rennin causes a semi-solid mass of milk solids (curd) to form and separate from the liquid (whey). The whey is removed and the curd is pressed, dried, aged, and made into cheese. All cheese is naturally white. Cheese can be yellow or orange because color is added.



©iStock/Torbjorn Lagerwall

FIGURE 27-9

Butter production uses 20% of all the milk produced.

Butter and Frozen Dairy Products The production of butter uses about 20 percent of the milk produced in the United States (Figure 27-9). Butter is made from cream. It contains at least 80% fat. Americans consume more than 4 pounds of butter per person per year. Making one pound of butter takes almost 2½ gallons (21 pounds) of whole milk.



History Connection

Legend says that butter was first discovered when milk was carried on horseback. The constant movement and shaking of the milk would “churn” the cream in the milk into butter.

did you know?

Butter or Margarine? Margarine was first developed as a low-cost substitute for butter. Dairy farmer groups had laws passed so that margarine could not be colored to look like butter. Margarine is naturally white in color. In its early days (early 20th century), white margarine was sold with a packet of coloring that the consumer could add into the product, making it visually more appealing.

In recent years, the consumption of saturated fats has led to health concerns. Saturated fats are found mostly in animal products. While butter is made from animal products and contains animal fat, margarine is mostly made from vegetable oil and does not contain saturated fats.



Delmar/Cengage Learning

FIGURE 27-10

Ten percent of the milk produced in the United States is used for frozen dairy products, including ice cream.

About 10 percent of the milk produced in the United States is used for frozen dairy products (Figure 27-10). The average American eats about

5½ gallons of ice cream each year, and 93% of U.S. households eat ice cream. Ice cream (made from cream), ice milk (made from milk), frozen yogurt, and sherbet are the major frozen dairy products.



Science Connection

Churning cream causes the fat globules in milk to stick together. When cream is shaken sufficiently, the membranes that surround the milk fat will rupture. Once broken, the fat droplets can join with each other to form clumps of fat, which get bigger and bigger as the churning continues. The motion of constant churning and stirring eventually causes all the fat in the cream to stick together in one large clump. The liquid is poured off and the remaining solid clump is butter.

About 4 percent of the milk produced in the United States is used to make dairy products such as evaporated and condensed milk, evaporated and condensed buttermilk, dry buttermilk, dry whole milk, dry non-fat and skim milks, dry cream, dry whey, lactose, and yogurt.

did you know?

Some dairymen choose to produce organic milk. Organic products generally sell at higher prices because it is costly for dairy farmers to follow the government standards required to receive the “USDA Organic” label. The National Organic Program (NOP) develops, implements, and administers standards for organic agricultural products. Among the requirements is that the cows be fed feedstuffs grown organically. This means that the feed must be grown using only organic fertilizers and pesticides.

The Purebred Dairy Cattle Association

In 1940, the Purebred Dairy Cattle Association (PDCA) was organized. The PDCA includes seven breeds of dairy cattle. The PDCA develops guidelines and rules, and influences policies that affect the dairy industry.

In the United States, there are seven major breeds of dairy cattle – Holstein, Red and Whites, Ayrshire, Brown Swiss, Guernsey, Jersey, and Milking Shorthorn. Breed selection is based on the desired traits that producers want in their herd. Producers selectively breed dairy cattle for longevity, butterfat content, milk production, and other characteristics. The two most desired characteristics are the ability to produce large volumes of milk and longevity in the herd (the number of years a cow will remain productive).

Holstein

The Holstein cattle breed originated in the Netherlands (Figure 27-11). The first Holsteins were brought to the United States in 1621. The Holstein-Friesian Association of America was organized in



©Stock/Chris Elwell

FIGURE 27-11

Holstein cow.

1885 and is known today as the Holstein Association of America. The Holstein is identified by black and white markings, and is one of the largest dairy cow breeds.

Each Holstein's spots are like fingerprints that are unique to that animal. Holsteins are the most prominent and numerous breed in the dairy industry. They account for approximately 93% of the dairy cattle in the United States. Holsteins rank highest in milk production per cow.

Holstein	
Origin	Netherlands
Brought to U.S.	1621
Color	Black and white

Red and Whites

The Red and White Dairy Cattle Association (RWDCA) was established in 1964. This association was based on the bloodlines of Red Holsteins, and was created separately from the Holstein Breed Association. The red and white colors are a recessive genetic trait (Figure 27-12).



Courtesy of Red and White Dairy Cattle Association (RWDCA)

FIGURE 27-12

Red and White cow.

Red and Whites	
Origin	United States
Association Formed	1964
Color	Red and white

Ayrshire

The Ayrshire breed originated in Scotland prior to 1800 (Figure 27-13). The first Ayrshire cattle were imported to the United States in 1822. The Ayrshire Breeders' Association was established in 1875. Ayrshires may be any shade of red, including cherry red, mahogany, or brown. The preferred color of this breed is red and white.

Ayrshire	
Origin	Scotland
Brought to U.S.	1822
Color	Red, mahogany, or brown

Brown Swiss

The Brown Swiss breed originated in the Alps in Switzerland (Figure 27-14). The first Brown Swiss cattle were imported to the United States in 1869.



©Stockphoto/Eric Isselee

FIGURE 27-13

Ayrshire cow.



Courtesy of the Brown Swiss Cattle Breeder's Association

FIGURE 27-14

Brown Swiss cow.

The Brown Swiss Cattle Breeders' Association was established in 1880. Brown Swiss are solid brown, ranging from light to dark. The nose and tongue are black. Brown Swiss cattle have the longest lifespan of the dairy breeds. They produce milk with a high butter fat content, and produce the second-highest quantity of milk of the dairy cow breeds.

Brown Swiss	
Origin	Switzerland
Brought to U.S.	1869
Color	Brown

Guernsey

The Guernsey breed originated on the Isle of Guernsey, off the coast of France (Figure 27-15). The first Guernsey cattle were imported to the United States in 1831. The American Guernsey Association was developed in 1877. The Guernsey breed is any shade of fawn with white markings. The milk of a Guernsey cow has a golden yellow color due to the high amount of **carotene**, which is a natural yellow

carotene

natural yellow pigment found in milk fat, egg yolks, and plants

FIGURE 27-15
Guernsey cow.



Courtesy of the American Guernsey Association

pigment found in milk fat. The Guernsey produces the second-highest percentage of butterfat among dairy breeds.

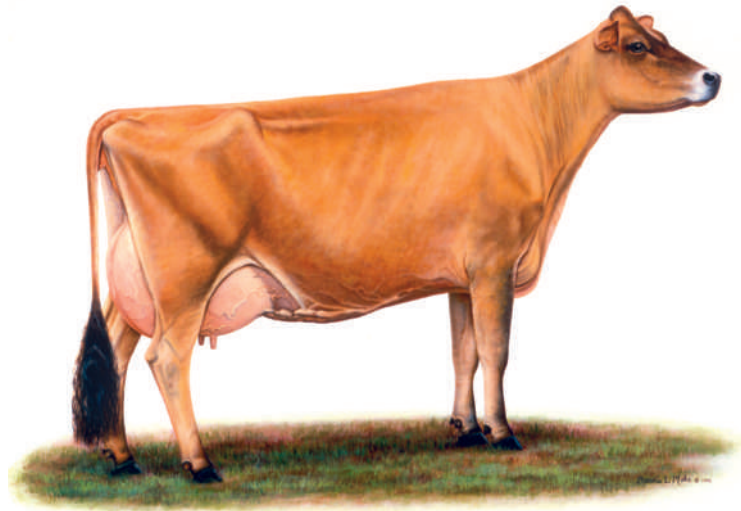
Guernsey	
Origin	Isle of Guernsey off the coast of France
Brought to U.S.	1831
Color	Fawn with white markings

Jersey

The Jersey breed originated on the Isle of Jersey, in the English Channel off the coast of France (Figure 27-16). The first Jersey cattle were brought to the United States in 1815. The American Jersey Cattle Association was developed in 1868. The Jersey breed is cream to light fawn to almost black in color. Jerseys are commonly darker on the hips and head than the body. The **switch** (hair on the end of the tail) is usually black, and the tongue is black or white. The Jersey is the smallest cow of the dairy breeds. However, milk production is far more important than color pattern or size. Jersey cows are known for having the highest percentage of butterfat in their milk.

switch

the hair on the end of the tail of a cow or other bovine animal



©iStock/Leandro Hernandez

FIGURE 27-16

Jersey cow.

Jersey	
Origin	Isle of Jersey off the coast of France
Brought to U.S.	1815
Color	Cream to light fawn to almost black

Milking Shorthorn

The Milking Shorthorn, a dairy breed, is closely related to the Shorthorn breed, a beef-type breed. Both the Milking Shorthorn and beef-type Shorthorn breeds have the same ancestors. Milking Shorthorns were declared a dairy breed in 1969. Since that time, great improvements have been made in the Milking Shorthorn breed. The cows have become more dairy-like and more angular with improved udder quality.

In 1882, the American Shorthorn Breeders' Association was formed to register and promote both Milking and beef-type Shorthorns. The American Milking Shorthorn Society (AMSS) was established in 1948, and began registration and promotion of Milking Shorthorns.

Originating in England, Shorthorns are red, red and white, white, or roan. The first importation of Shorthorns to the United States was in 1783. They were popular in colonial America as a dual purpose breed, providing milk and meat. Shorthorns also provided power and transportation. In early America, Shorthorns were used as oxen to provide power for plowing and other farm work. They were also used to pull wagons for the colonists who moved across America.

Milking Shorthorn	
Origin	England
Brought to U.S.	1783
Color	red, red and white, white, or roan



History Connection

"THE HONEST OLD COW"

President Dwight D. Eisenhower was raised on a Kansas farm and often recalled this story from boyhood: "An old farmer had a cow that we wanted to buy. My daddy and I went over to visit him and asked about the cow's pedigree. The farmer didn't know what pedigree meant, so we asked him about the cow's butterfat production. He told us that he hadn't any idea. Finally, we asked him if he knew how many pounds of milk the cow produced each year. The farmer shook his head and said, 'I don't know. But she's an honest old cow and she'll give you all the milk she has!'"

Summary

Dairy cows produce 85% of the world's milk. The U.S. dairy industry uses cattle almost exclusively, although goats and other animals are also used for dairy. The dairy industry has made great strides in the past few decades. It has led most other agricultural industries in the use of technology, artificial insemination, and production.

The total number of dairy farms is decreasing but the average size of dairy farms is increasing. While the total number of dairy cows has been decreasing, total milk production and milk production per cow has increased significantly. The top producing dairy states are California and Wisconsin.

Milk has been called nature's most nearly perfect food. Although about 85% water, milk is loaded with proteins, vitamins, and minerals. Milk is fortified with Vitamin D, an important vitamin essential for the absorption of calcium and phosphorus. Americans consume the equivalent of 600 pounds, about 69 gallons, of milk and milk products per person per year.

Milk is produced in the cow's udder, making the udder the most important part of the dairy cow. The alveoli receive nutrients from the blood and convert them to milk. The milk passes through different parts of the udder and finally through the teat during milking.

The commercial milk industry began to develop rapidly with the widespread use of refrigerated railroad cars and fast, reliable transportation methods. Several technologies came together that allowed expansion of the dairy industry, including the refrigerated railcar in the 1840s, condensed milk in 1856, the canning process in 1861, pasteurization in 1865, glass milk bottles in 1884, and homogenization in 1919.

Milk is graded as either Grade A or Grade B. Grade A milk can be used for all purposes, but Grade B milk can only be used for making cheese and other dairy products. Grade A milk accounts for 95% of the milk produced in the U.S. The usage of milk is about one-third for fluid consumption, one-third for butter, yogurt, and frozen products, and one-third for cheese making.

There are seven major breeds of dairy cattle used in the U.S. – Holstein, Red and Whites, Ayrshire, Brown Swiss, Guernsey, Jersey, and Milking Shorthorn. Holsteins produce the most milk per cow. About 93% of the dairy cows in the U.S. are Holsteins.

Quick Facts

- Dairy cows produce 85% of the world's milk.
- The dairy industry has made great improvement in production through genetic advances and the use of technology.
- A key to the success of the dairy industry has been record keeping. Dairy farmers have traditionally kept the best records of any agricultural group, allowing them to select the best animals and make better management decisions.
- The number of dairy farms is decreasing, the average size of dairy farms is increasing, and the total number of dairy cows is decreasing. However, total milk production continues to increase.
- A number of technologies helped in development of the modern dairy industry. Two of the most important were the refrigerated railroad car and fast, reliable transportation methods.
- The states with the highest numbers of dairy cattle are California, Wisconsin, New York, Pennsylvania, and Minnesota.
- Milk comes from a cow's mammary gland – the udder. Therefore, the udder is the most important part of a dairy animal.
- Grade A milk can be used for any purpose, but the use of Grade B milk is restricted for products such as cheese.
- Almost all milk produced, 95%, is Grade A milk.
- Milk is one of the most highly regulated foods. It is tested for five major contaminants: bacteria, somatic cells, antibiotics, sediment, and water content.
- Milk has three basic uses. In the U.S., one-third is used as fluid milk, one-third is made into cheese, and one-third is made into butter, yogurt, and frozen dairy products.
- Americans consume over 600 pounds (about 69 gallons) of milk each year.
- There are seven major purebred dairy breeds: Ayrshire, Brown Swiss, Guernsey, Holstein, Red and Whites, Jersey, and Milking Shorthorn.

Student Learning Activities

1. Prepare and present an oral report on the dairy industry.
2. Observe videos on dairy production or visit a local dairy farm.
3. Keep a log of dairy consumption for your family. Compile the results for the class.
4. Prepare a bulletin board display of dairy products.
5. Study the seven major dairy breeds online. Prepare a chart that gives a description, distinguishing characteristics, and general facts for each breed.

Discussion Questions

1. Explain the heritage of the Milking Shorthorn breed.
2. Why are organic dairy products generally higher in price than regular dairy products?
3. Why is milk production rising even though the number of dairy cows is declining?
4. Name and describe the seven major breeds of dairy cattle used in the United States.
5. Why are Holsteins the most popular dairy cattle breed?

Review Questions

True/False

1. Milk is fortified with Vitamin D.
2. The number of milk cows on farms in the United States has shown a steady decline for many years.
3. There are five major breeds of dairy cattle in the United States.
4. Holsteins are the smallest of the dairy cattle breeds.
5. Jerseys rank first among dairy breeds in the average amount of milk fat produced per cow.

Multiple Choice

1. What is the breed of cattle that ranks first in average milk production per cow?
 - a. Jersey
 - b. Holstein
 - c. Guernsey
 - d. Brown Swiss
2. Which of the following did NOT help make milk a viable commercial commodity?
 - a. Refrigerated rail cars
 - b. Cream cups
 - c. Milking machines
 - d. Improved herd genetics
3. What process keeps cream from rising to the top of whole milk?
 - a. Refrigeration
 - b. Pasteurization
 - c. Homogenization
 - d. Fortification
4. In the dairy industry, milk is measured not by the gallon but by the _____.
 - a. quart
 - b. tank
 - c. CWT
 - d. density
5. This grade of milk may be used for any purpose:
 - a. Grade A
 - b. Grade B
 - c. Grade C
 - d. Raw

Completion

1. Holsteins are _____ and _____ in color.
2. The _____ breed of dairy cattle originated in Scotland.
3. The _____ _____ _____ develops guidelines and rules, and influences policies that affect the dairy industry.
4. The _____ of _____ protects consumers and producers from fluctuating milk prices.
5. Of all the milk produced in the U.S., _____ percent is used for fluid milk, _____ percent is used for butter, yogurt, or frozen products, and _____ percent is used for cheese.

Short Answer

1. Describe the Jersey cattle breed.
2. Where did the Brown Swiss breed originate?
3. When were the first Holsteins brought to the United States?
4. What is pasteurization?
5. Name the five contaminants that milk is tested for.



CHAPTER 28

Management of Dairy Cattle

OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Formulate goals for a dairy farm.
- Explain the importance of record keeping in dairy operations.
- Describe breeding methods and systems in dairy operations.
- Describe housing for dairy cattle.
- Outline feeding programs for a dairy operation.
- Describe milk management and marketing practices.
- Explain manure management in dairies.
- Describe procedures for maintaining herd health.

KEY TERMS

Dairy Herd Improvement (DHI)

Dairy Herd Improvement Association (DHIA)

stanchion barn
free stall barn

dry cow

sex-selected semen

fetus

heritability

inbreeding

gene pool

culling

lactating

genetic potential

colostrum

silage

fermentation

anaerobic

body condition score (BCS)

milking parlor

carousel

bulk tank

mastitis

ketosis

milk fever

fortify

dairy cooperative

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Milking Parlor	Salle de traite	Melken salon	Salotto di mungitura	El Salón Lechero
Udder	Pis	Euter	Mammella	La Ubre
Pasteurize	Pasteurisent	Pasteurisieren	Pastorizzare	Pasteurizar
Butterfat	Gras de beurre	Butterfett	Materia grassa del burro	La Grasa de La Leche

Introduction to Dairy Management

The modern dairy farm is a high investment, competitive enterprise requiring specialized buildings and equipment (Figure 28-1). Dairy farming is labor-intensive, requiring at least 2 milkings per day, 7 days a week, 365 days a year. Mechanization can reduce some labor requirements, but the investment is higher.

Good management is essential for the profitable operation of a dairy. Producers must provide the best care possible for dairy cows. Healthy cows that are not under stress produce the most milk and provide the most profit.



Courtesy of CST Industries; Harvestore Farm

FIGURE 28-1

Dairy farming is a high-investment, labor-intensive business.

Management Records

Dairy Herd Improvement (DHI)

a program that tracks the feeding, reproduction, health, and production of each cow in the herd

Dairy Herd Improvement Association (DHIA)

an organization that provides production testing services to dairies

Well-kept records serve as the basis for business management decisions. Records on feeding, reproduction, health, and production should be kept on every cow in the herd (Figure 28-2). It is recommended that dairies participate in a **Dairy Herd Improvement (DHI)** program.

Dairy Herd Improvement Association (DHIA)

The **Dairy Herd Improvement Association (DHIA)** has been a major force in dairy record keeping and herd improvement. The Dairy Herd Improvement Association was formed by a group of dairy producers to provide production testing services for evaluating dairies. DHIA program records provide farms with detailed information on individual cows for culling, breeding, and other management decisions.



Technology Connection

Some dairies now insert microchips into their cows. When the cow enters the milking parlor, a sensor determines which cow has entered. Production information is recorded every time the cow is milked.

FIGURE 28-2

Most dairy farmers use computer programs to track production, feeding, health, and reproduction of cows.



Courtesy of the USDA



Math Connection

The average productive life of a dairy cow is about four years. This means that 1 in 4 cows, or 25% of the herd, have to be replaced each year. If a dairy farmer has 180 cows and 25% have to be replaced, 45 replacement cows will be needed each year.

Housing

Housing systems for dairies can be complex systems, simple systems, or anything in-between. These housing systems are directly related to the weather for the region in which they are located. For example, cows in Wisconsin would need a different housing system than cows in Arizona.

Milking Herd (Producing Cows)

Many types of housing systems are used for the milking herd (Figure 28-3). The two most common housing types are **stanchion (tie stall) barns** and **free stall barns**. Free stall barns have become much more popular than tie stall barns.

Bedding should be provided for the comfort of the cow. Bedding also helps to keep the cow and her

stanchion barn

a barn that is constructed so that each cow is confined to an individual stall; also called a tie stall barn

free stall barn

a loose housing system that has many available stalls that cows may enter and leave as they desire

FIGURE 28-3

This is a free stall housing system. The cows can move about the barn or rest in a stall.



Courtesy of Catrina Kennedy

udder and teats clean, which helps prevent mastitis and other diseases. The stall should be designed to allow manure and urine to flow or fall into the alleyway for cleanup. A variety of bedding choices are available, with sand being the most common.

In tie stall barns, each cow is confined to an individual stall. In a free stall or loose system, cows are not confined to an individual stall. Stalls in either system must be large enough for the cows to comfortably stand, lie down, and rest. In free stall barns, the cows may enter and leave the stalls whenever they want.

did you know?

Dairy farmers are constantly trying to make their cows more comfortable, since content, stress-free cows give more milk and stay healthier. Providing cows with clean, dry bedding is one way to make them more comfortable. Some farmers have tried waterbeds, though they are not widely used. Waterbeds have many advantages. They can be washed off easily and last for several years. The waterbed conforms to the cow's body and helps prevent injury and swelling of the joints, hocks, and ankles.



Delmar/Cengage Learning

FIGURE 28-4

Calves are normally housed in individual calf hutches.

Calves

Dairy calves are removed from their mother shortly after birth and are bottle-raised. Young calves are housed in individual portable hutches (Figure 28-4) or in confinement calf barns. Calf housing must be clean, dry, well-ventilated, and provide protection from severe weather. Bedding includes wood shavings, sawdust, and straw.

Replacement Heifers

When calves are weaned, they may be kept in group pens by size. The heifer calves may be kept for replacements while the bull calves are usually sold.

dry cow

a cow that is not producing milk

sex-selected semen

male reproductive fluid containing only the sperm that will produce calves of the desired sex



Courtesy of ABS Global, Inc.

FIGURE 28-5

Most dairies use artificial insemination (AI) for breeding.

Heifers are usually raised on pasture until they calve at about two years of age. Then they are moved to the milking herd.

Dry Cows

Dry cows are cows that are not currently giving milk. They are isolated from the milking herd. Cows become dry, or stop giving milk, shortly before they give birth to another calf. Just before calving, dry, pregnant cows are usually moved to individual calving pens or clean pastures.

Breeding

The dairy industry has led the other animal industries in breeding technology. Selective breeding has led to huge strides in increased milk production. Good records have made breeding for increased milk production successful.

Artificial Insemination

Most dairies in the United States use artificial insemination (AI). The use of AI allows the dairy farmer to select from a wide choice of genetically superior bulls (Figure 28-5). The risk of disease is less with AI, and the cost and problems with keeping a bull are eliminated. With AI, semen from one superior bull can be shipped across the country, and world, to produce thousands of calves.

For dairymen, heifer calves are desirable over bull calves because of their value as additions to the milking herd, or to sell to other producers. **Sex-selected semen**, also known as gender-selected and sex-sorted semen, is available to assure dairymen a high percentage of heifer calves. In sex-selected semen, the sperm carrying the male-producing Y chromosome are separated out of the semen and discarded. Over 90 percent of the calves born through artificial insemination with sex-selected semen can be expected to be heifers.



Courtesy of Shannon R. Lawrence

FIGURE 28-6

Replacement heifers should be of sufficient size before breeding. Heifers should be bred so that they will calve at about two years of age.

Heat Detection

The estrous period or heat period is the time that cows may be bred. The average cow comes into heat every 21 days and stays in heat for an average of 15 to 18 hours. Cows can only become pregnant during the heat period. A problem with artificial insemination is that it can be difficult to determine when a cow is in heat. Careful and frequent observation of the herd for cows in heat is necessary. A good record keeping system will also help by indicating when to expect certain cows to come into heat.

Breeding Heifers

An important part of successful dairy management is raising replacement cows for the milking herd. Twenty-five percent or more of the cows in an average milking herd must be replaced each year. The dairy farmer must either raise or purchase replacement heifers (Figure 28-6).

It is recommended that heifers be bred according to size rather than age. With proper nutrition, heifers should reach the right size for breeding at about 14 to 15 months of age. If bred at 15 months, a heifer will calve at about 2 years of age. Heifers should weigh about 60 percent of their mature weight at the time of breeding. Heifers need more feed during gestation because their bodies are still growing in addition to supporting a **fetus** (calf).

Improving the herd by raising replacement heifers begins with a well-managed breeding program. Selecting good sires and dams is the key to genetic improvement. The traits selected in a dairy herd breeding program have different levels of **heritability** (Table 28-1).

Heritability is the capability of traits being passed from one generation to the next. It is estimated from an animal's performance records. The lower the heritability score, the slower the genetic progress in improving that trait. Commercial dairy farmers should place emphasis on selecting traits for milk production.

fetus

unborn animal that is still developing in the womb

heritability

a measure of the traits passed from the parents to the offspring

TABLE 28-1

Heritability of Dairy Traits

Trait	Heritability (%)
Fat, solids not fat, protein (%)	25
Stature	50
Teat placement	20–31
General appearance	25–29
Milk or fat production	25
Final type classification score	20–30
Mastitis resistance	20–30
Milking qualities	20–30
Rump	25
Feed efficiency	25
Back	23
Fore udder	21
Rear udder	21
Udder support	21
Body capacity (type score)	15–25
Mammary system	15–25
Dairy character	19
Hind legs	15
Longevity	0–15
Front end	12
Feet	11
Head	10
Rate of maturity	0–10
Breeding efficiency	0–10
Disposition	0–10
Udder quality	0

inbreeding

the mating of two related individuals

gene pool

the complete collection of genetic information for a group

culling

removal of animals from the herd

Crossbreeding

In recent years, crossbreeding dairy animals has become popular. At one time, only purebred animals were used in commercial dairies. Crossbreeding dairy breeds has become popular because there has been a lot of **inbreeding** in the purebred dairy lines. The wide-spread use of artificial insemination has led to the same top-producing bulls being used across the country, increasing the chances for inbreeding. When the same bulls are the fathers of many offspring at a large number of farms, the **gene pool** is limited. The gene pool is the complete collection of genetic information for a group. Crossbreeding helps to expand the gene pool, not limit it. Crossbred cows are healthier because of hybrid vigor.



Science Connection

Who's Related to Whom? Inbreeding is becoming a problem in the dairy industry due to the use of genetically superior bulls. When a genetically superior bull becomes popular, he is widely used in AI programs across the country. This causes the shrinking of the gene pool, making it more likely that inbreeding will occur.

Calving

The average gestation or length of pregnancy for a dairy cow is 283 days. During warm weather, a clean pasture, if available, is the best place for calving (Figure 28-7). A clean, well bedded stall is needed during cold or inclement weather for the birthing process. During calving, the cow should be watched closely but not disturbed unless it becomes apparent that assistance is needed.

Culling

Culling means to permanently remove cows from the herd. The most common reason for culling is low milk production. Cows may be culled for a number



©Stock/Herman Wieten

FIGURE 28-7

A healthy calf will be on its feet shortly after birth.



Delmar/ Cengage Learning

FIGURE 28-8

Feed accounts for about 50 percent of the cost of dairy production.

lactating

producing milk

genetic potential

the point at which an animal's production will stop increasing no matter what other factors, such as feed, are increased or improved

of other reasons, including reproduction problems, diseases, and udder problems. The productive life of a dairy cow was once 10 years or more. Based on the pressure for ever-increasing milk production, the average productive life of a dairy cow has decreased to about 4 years.

Feeding

Feed costs are about 50 percent of the total costs on a dairy farm (Figure 28-8). A dairy producer will keep close track of all the feedstuffs used in order to maximize milk production and profit. Cows need varying amounts and types of feed depending on their age, size, and stage of production (lactating, dry, etc.).

Lactating Dairy Cows

Lactating dairy cows, which are those that are producing milk, need more feed than non-producing cows. Cows need to be fed balanced rations to produce the most milk. Feeding has the most influence on the amount of milk a cow produces. Generally, lactating cows are on full feed because the more the cow eats, the more milk she produces. However, milk production of the individual cow is limited by heredity – her **genetic potential**. Genetic potential is the point at which an animal's production will stop increasing no matter what other factors, such as feed, are increased or improved. For that reason, it is important to keep detailed records and obtain the best genetics affordable.

Dry Cows

Dry cows are cows not producing milk. Cows need a dry period before giving birth to another calf. Dry cows are usually fed a diet of good quality grass hay or pasture during this period. This allows the cow's body to rest and repair itself before giving birth and going back into the milking herd. Dry cows should not be overfed or underfed.

colostrum

first milk produced after giving birth

silage

feedstuff made from green forage and grain crops that are harvested, chopped, fermented, and then stored for feeding at a later date

fermentation

the process by which bacteria convert carbohydrates into alcohols and acids



Delmar/Cengage Learning

FIGURE 28-9

Silage is the basis for dairy rations.

Calves from Birth to Weaning

Calves are born with little or no immunity to disease. Like most animals, calves are dependent on antibodies from their mothers' colostrum milk for protection against disease. **Colostrum** milk is the first milk secreted by the cow after calving. Colostrum, as compared to regular milk, is high in fat, non-fatty solids, total protein, and antibodies that protect against disease. It is critical that the calf receives colostrum milk within a few hours, preferably in the first hour, after birth. Calves lose the ability to absorb the antibodies at about 24 hours of age. Calves are fed a milk-based diet for 8–9 weeks, at which time they are weaned off milk and put on a feed mixture.

Feedstuffs

Feedstuffs for dairy cattle are very diverse, depending on the geographic location. The same feedstuffs might not be available to farmers in the Northwest as compared to farmers in the Southeast or other parts of the country.

Roughage Dairy cattle are ruminants. As with other ruminants, the basic ingredient of dairy rations is roughage. Dairy cows eat large amounts of roughage, such as pasture grasses, hay, haylage, and silage. When these are grown on the farm, they are the cheapest source of feed. Roughages vary widely in quality due to the type of plant and growing and storage conditions.

Silage Dairy production relies heavily on the production of silage for feed. Almost any crop can be made into silage. **Silage** is made from green forage and grain crops that are harvested, chopped, fermented, and then stored for feeding at a later date (Figure 28-9). It is stored on the farm in silage bags, silos, or silage bunkers.

Through **fermentation** of the feedstuff, bacteria convert carbohydrates into alcohols and acids.



©Stock/Chad Reisch

FIGURE 28-10

Corn silage is a popular feedstuff for dairy cattle rations.

anaerobic

a process that occurs without oxygen

The fermentation that takes place in this manner is **anaerobic**, or without oxygen. Grasses, corn, and small grains are common kinds of silage used in dairy rations. Silage has a higher moisture content than hay and other dry roughages.

Corn silage is a highly palatable feed, and is one of the most popular ingredients in dairy cattle rations (Figure 28-10). Corn silage yields more energy per acre than other forages.

Hay The feeding value of any hay depends on the type of plant, stage of maturity when cut, and the harvesting and storing methods. A high percent of the nutrient value of hay is in the leaves rather than in the stems. Hay that is rain-damaged has a lower feeding value compared to similar hay that is not rain-damaged. Legume hays contain more protein than grass hays.

Pasture The effective use of pasture for the dairy herd requires good management (Figure 28-11). The use of pasture reduces the labor needed for feed and manure handling. Pastures are an excellent source of roughage for dry cows and growing heifers.

Several problems may occur if pastures are used to feed lactating cows. These include off-flavors in the milk and difficulty getting cows to come into the milking parlor. Milk normally has a clean, pleasant, and slightly sweet flavor. Lactating cows grazing on pasture may give off-flavored milk depending on the types of plants in the pasture. The dairy farmer must follow good management practices to prevent off-flavors in milk.



Delmar/Cengage Learning

FIGURE 28-11

Pasture access for dairy cows reduces the labor requirements for feed and manure handling.

Grains

Grains, such as corn and oats, are included in dairy rations mainly for their energy content. It is important that lactating dairy cows get enough energy from their rations. Corn is the most commonly used grain in dairy cattle rations. It is high in energy and is palatable. Corn is usually a cheaper energy source than other grains.

Protein Supplements

A protein supplement, such as soybean meal, is added to the ration to make up the difference between what the cow needs and the amount of protein supplied by the rest of the ration. Protein supplements are usually the most expensive part of the ration. Therefore, care must be taken to carefully balance the ration so that the cow is given what she needs, while at the same time, the feed costs are kept as low as possible.

Minerals and Vitamins

As with all animal feeds, proper mineral and vitamin supplementation in dairy feed is essential to animal health and production. The amount of minerals and vitamins to be added to dairy rations should be gauged by a laboratory analysis of the silage or other feed to determine the amount of supplementation necessary.

Water Needs

Milk is 85 to 87 percent water. Lactating dairy cows require more water in relation to their size than any other farm animal. These cows need roughly 20 gallons of water per day. Dairy cattle suffer quicker from a lack of water than from a lack of feed. Dairy cows may produce over 100 pounds of milk per day, which requires 10.5 gallons of water, in addition to the water required to maintain a proper fluid balance in the cow's body. Milk production, along with normal body needs, make it imperative that fresh, clean water be available at all times.

Body Condition Score

body condition score (BCS)

a numerical score indicating the estimated amount of fat on an animal's body

Body condition score (BCS) refers to the amount of fat on the body of the animal. This is an important part of modern dairy management. Scores range from 1 (very thin) to 5 (excessively fat). Producers visually examine the animal and estimate the body condition score of the cow.

FIGURE 28-12

This dairy cow has a body condition score (BCS) of 3.



Courtesy of the USDA

For maximum efficiency in milk production, dairy cows must not be too thin or too fat. Using body condition scoring to evaluate the herd helps the dairy farmer to improve feed efficiency and maintain herd health. Thin cows have more health problems and are not as productive; cows that are too fat have more difficulty calving and feed costs that are unnecessarily high. Depending on the stage of production, cows should have a body condition score of 3–4 (Figure 28-12).

Milking Management

With the advent of mechanization, present-day dairy farmers can milk far more cows than in the past. But there are strict guidelines placed on the purity of milk and milk products that the producer must follow. These guidelines are enforced by government inspectors. Although it is extremely efficient, mechanization is expensive. Milk management includes following guidelines to deliver a wholesome product to the consumer. The milking parlor is the most expensive, high-tech facility on the dairy farm.

Milking Parlors

A **milking parlor** is a separate area where the cows are milked. Milking parlors are cleaned daily to help prevent disease and milk contamination.

milking parlor

the area where cows are milked

FIGURE 28-13

The most popular milking parlor design in current use is the herringbone.



Courtesy of Scott Register and Catrina Kennedy

carousel

a type of milking parlor; the cows are placed on a circular rotating platform, and when the cows complete a full rotation, they should be fully milked

Three types of milking parlor designs are the herringbone, side-opening, and carousel. The most common milking parlor is the herringbone (Figure 28-13). In the herringbone parlor, the cows enter and leave in groups. Cows stand at an angle to the operator.

The **carousel** has become popular because it is highly automated and requires less labor. The carousel is a circular platform on a track that circles slowly. All the cows face the same way, and their udders are accessed from the rear. It takes the average cow 3–5 minutes to give her milk when a milking device is attached to her udder. By the time the platform has completed a full rotation and a cow gets all the way around, she should be done milking.

The operator pit for all milking parlors is basically the same. It is usually about 30 inches (76 cm) below the level at which the cows stand. The cows are turned so that their udder is facing toward the pit area. The operator cleans the udder and teats, and checks the udder for disease or physical problems. After the udder is cleaned, the milking device is attached to the cow's teats and the milking process begins (Figure 28-14). The milking machine uses pulsating pressure to pull on the cow's teats and release the milk.



Delmar/Cengage Learning

FIGURE 28-14

The teat cups are the tubes which attach to the teats of the cow for milking.

Milking Intervals

Regular milking is important to maintain high production. A commercial dairy cow is usually milked twice a day. Milking cows three times per day will increase total milk production up to 20 percent compared to twice-daily milking. However, a major cost of milking three times per day is labor.

Milk Quality

The production of high-quality milk requires good management practices. The characteristics of high-quality milk include:

- ▶ No dirt and other sediment
- ▶ Low bacteria count
- ▶ No chemical contamination
- ▶ Low somatic cell count (body cells of the cow)
- ▶ Good flavor

Keeping Bacteria Count Low

Bacteria are single-celled organisms which may cause disease. A high bacteria count lowers milk quality. Several types of bacteria may be found in milk, such as salmonella, *E.coli*, and listeria. Most bacteria grow in warm or hot milk. Cooling milk retards bacterial growth.

Problems caused by bacteria in milk include:

- ▶ Souring of milk
- ▶ Reduced shelf life of milk
- ▶ Off-flavors in milk
- ▶ Disease transmission through milk

Bulk Tanks

Milk that has been extracted from the cow using a mechanical milking device will travel through a series of pipes from the milking parlor to a **bulk tank**

bulk tank

a stainless steel tank used for storing milk at a dairy farm



Delmar/Cengage Learning

FIGURE 28-15

Milk bulk tanks should be made of stainless steel and must keep the milk at 45°F or lower.

(Figure 28-15). Bulk tanks are stainless steel tanks that hold all the milk from the dairy. The milk in the bulk tank is cooled and stored until it can be picked up. Bulk tanks must be capable of quickly cooling milk to 45°F. It is important that the milk be held at 45°F or below to prevent bacterial growth. Milk trucks pick up the milk from the dairy bulk tanks and take the milk to the processing plant.

Manure Management

Manure management is a major concern for dairy farmers. A dairy cow can generate up to 150 pounds of manure per day. Conditions must be maintained as clean as possible for milk production, which means manure must be removed on a regular basis. In addition, there are governmental regulations that must be met regarding manure management.

A tractor scraper and a front-end loader may be used in free stall housing. Automatic scrapers may be used, or water can be used to wash the alleyways clear of manure (Figure 28-16 through Figure 28-18). The manure may be scraped through grates directly into a storage tank or into a holding tank to be pumped into a storage area.

FIGURE 28-16

In free stall dairy housing systems, the elevated platform is designed to be long enough for a cow to lie down comfortably, but short enough for the manure and urine to be released into the alleyway.



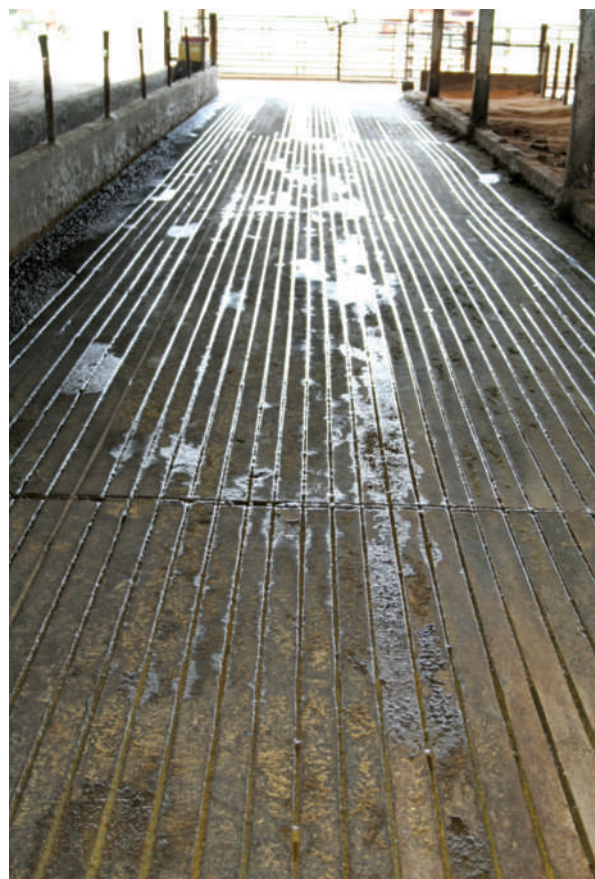
Delmar/Cengage Learning



Courtesy of Shannon R. Lawrence

FIGURE 28-17

In flush systems, the alleyways are flooded with water, usually recycled water, at preset intervals, which washes the manure.



Courtesy of Shannon R. Lawrence

FIGURE 28-18

Clean alleyways after they have been flushed with water. Flushing the alleyways with water helps to keep the cows and facilities clean.

Dairy Herd Health

Dairy cattle are subject to most of the same disease and parasite problems that affect beef cattle. See Chapter 11 for a discussion of cattle diseases and parasites. However, there are some health considerations that need to be emphasized concerning dairy cattle.

Dairy Cow Health

The dairy farmer should develop an overall plan for maintaining the health of the herd. An effective plan puts emphasis on the prevention of problems. The services of a veterinarian should be used (Figure 28-19). It is important to keep health records on all animals in the herd.



Courtesy of the USDA

FIGURE 28-19

Dairy farmers should rely on a veterinarian to help set up a comprehensive health program for the herd.

Keeping accurate reproduction records is extremely important. Have a veterinarian examine any cows with breeding or calving problems. Make routine pregnancy examinations and keep accurate records of breeding and calving dates.

Follow a planned program of health care. Many herd health problems are reduced by good management. Good management practices include:

- ▶ Proper feeding of the herd.
- ▶ Good facilities that are ventilated properly.
- ▶ Using clean, dry bedding.
- ▶ Proper cleaning and sanitation of facilities and equipment.
- ▶ Controlling disease carriers such as flies, birds, and rodents.
- ▶ Isolating all sick animals from the herd.
- ▶ Using a veterinarian for a quick, accurate diagnosis and treatment of health problems.
- ▶ Requiring visitors to use some type of protective footwear covering and/or a disinfectant foot dip at the entrance to the facilities.
- ▶ Not allowing visitors to have unlimited access to areas where the cows are kept.

mastitis

inflammation of the udder



Courtesy of James Lawhead, DVM

FIGURE 28-20

Normal milk is shown on the left, and an abnormal secretion from a cow with coliform mastitis is shown on the right.

Common Diseases in Dairy Herd Health

A veterinarian should be called if any of the following diseases or conditions emerge.

Mastitis **Mastitis** is a serious economic problem for dairy farmers (Figure 28-20). Mastitis is an inflammation (infection) of the udder. This infection can cause permanent damage to the udder if not treated properly. The infected quarter and teat become inflamed and hot, and this condition is very painful for the cow. Mastitis is usually caused by bacteria that get into the udder through the teat opening, or through a cut or scrape on the udder or teat.

A carefully planned and followed mastitis control program is essential for a dairy farm. The

ketosis

a nutritional disorder in dairy cows, most often occurring in high producing cows in the first 6–8 weeks after calving

milk fever

a disorder caused by a shortage of calcium in the blood

control program must be designed to both reduce the number of new infections and effectively treat existing infections in the dairy herd.

Ketosis **Ketosis** is a nutritional disorder in dairy cows. It most often occurs in high producing cows during the first 6 to 8 weeks after calving. Feeding a properly balanced ration will help prevent ketosis. A veterinarian should be consulted if ketosis is suspected.

Milk Fever **Milk fever** is caused by a shortage of calcium in the blood. It is more common in older, high-producing cows. It usually occurs within a few days after calving.

Dehorning

Horns on dairy cattle do not have any useful purpose. Cows without horns are easier and safer to handle. Horns can cause serious injury to other cows, and to people working with the cows. It is recommended that all replacement heifers be dehorned (Figure 28-21).



Delmar/Cengage Learning

FIGURE 28-21

Dehorning makes handling cows easier.

Hoof Trimming

Care of the feet of dairy cows is very important. Hooves may grow too long, crack, become infected, and break off (Figure 28-22). Cows with poor feet may be in pain, become sickly, and often have lower milk production. Hooves should be trimmed and cleaned occasionally.



Delmar/Cengage Learning

FIGURE 28-22

Care and trimming of hooves is a good practice to prevent disease and assist in the comfort of the cow.

Milk Processing

After the milk leaves the dairy, there are many steps to processing the milk. Unprocessed milk must be kept cool. At the processing plant, the milk is pasteurized, homogenized, and fortified. Other steps must also occur before the final product is put on the shelves at the grocery store.

Cooling Milk

Bacteria grow and multiply rapidly in warm milk. To prevent or retard bacterial growth, dairy farmers cool the milk to 45°F (4°C). Milk must not be allowed to warm up after it is cooled.



Science Connection

Pasteurization is an important part of milk processing because it kills harmful microorganisms such as bacteria in milk. Milk is pasteurized through a controlled heating process that kills harmful organisms, increasing shelf life. However, not all bacteria are killed. In order to kill all the bacteria, the milk would need to be heated to boiling (212°F), but this high temperature would adversely affect the taste and quality of the product. The process of pasteurization only heats the milk to 161°F, but it is a high enough temperature so that the number of bacteria is greatly reduced. There are still some bacteria present, but they are unlikely to cause the milk to sour if the milk is kept cold and is consumed by the expiration date on the carton. It is important to keep milk refrigerated as it travels from the farm to the consumer because bacteria cannot grow as quickly in a cold environment. If left at room temperature, bacteria will multiply rapidly and cause the milk to spoil.

Homogenization

Milk is an oil-in-water mixture, with the fat globules (oil) dispersed in the skim milk (water and water-solubles). The fat in milk, when collected, is known as cream. Homogenization is the mechanical process that makes the fat globules small enough so that they stay mixed with the watery part of the milk. If milk has not been homogenized, the large globules of fat will separate and rise to the top, forming a layer of cream that floats on the surface.

Fortification

Processed milk is **fortified** with vitamin D, vitamin A, and calcium. Fortifying milk means to add items to the milk to increase the nutritional value. Vitamin D is added to the milk to aid in the absorption of

fortify

to add nutrients to a product



Courtesy of the USDA

FIGURE 28-23

Careful management of dairies helps to limit the chance of milk contamination.

dairy cooperatives

a business that is owned, operated, and controlled by dairy producers

did you know?

“Got milk?” – Probably one of the world’s most famous tag lines or slogans is the “Got milk?” logo and the milk mustache. This demonstrates the power of marketing. The slogan was started for the California Milk Processor Board in 1993, and since has been used to promote the consumption of milk across the United States.

calcium from the milk. Normally, vitamin A is contained in the fat portion of the milk. For certain milk products that have had most or all of the fat removed, such as low-fat and skim milk or yogurt, vitamin A is added to increase the nutritional value. Calcium is sometimes added to milk and other dairy products, which then become calcium-fortified products.

Preventing Chemical Contamination

Improper use of chemicals and medicines can cause milk contamination. Medicinal and chemical residues are not permitted in milk. If milk becomes contaminated, then it cannot be sold. Milk is thoroughly tested, and is one of the most highly regulated foods.

Milk must be tested at the farm and at the processing facility for contamination (Figure 28-23). One of the most important tests that are performed on the milk is to detect whether or not there are any antibiotic residues in the milk. Antibiotics are used to treat diseases of the cows, and if not handled properly, may contaminate the milk. Government regulations prevent the processing and sale of milk that is contaminated with antibiotics. If a load of milk comes into the processing facility and is found to be contaminated with antibiotics, the whole truckload of milk has to be dumped.

Cooperatives

Dairy farmers have used cooperatives to help them market their products since the mid-1800s. A **dairy cooperative** is a business that is owned, operated, and controlled by the dairy producers who are members. Cooperatives provide a variety of services for their members. The major service of a dairy cooperative is to market milk and dairy products for their members. About 86% of dairy products are sold through dairy cooperatives.

Summary

Records are an important management tool on the dairy farm. The Dairy Herd Improvement Association (DHIA) provides many programs that help the dairy farmer increase profits through good record keeping.

Two types of housing used for the milking herd are tie stall (stanchion) barns and free stall barns. Free stall systems are the most common. Young calves are usually housed in individual portable hutches, and then moved into group pens. Housing must be clean, dry, well-ventilated, and should protect the calves from inclement weather.

Dry cows are cows that have stopped producing milk. Proper feeding and management of dry cows is an important part of dairy farming. Dry cows should not be allowed to become too fat or too thin. Dairy herd replacement heifers can either be raised by the producer or purchased. About 25% of the cows in a dairy herd will need to be replaced each year. Economically important traits should be considered when breeding cows. A breeding program should be based on the goals for the dairy farm. Dairy farmers make extensive use of artificial insemination. The use of artificial insemination made the rapid improvement in dairy herd genetics possible.

Feed costs are about 50 percent of the total cost of producing milk. Feeding balanced rations permits the cow to produce the amount of milk that is closest to her maximum genetic potential. Corn silage is a major ingredient in dairy rations.

Lactating dairy cows need more water than most other farm animals due to heavy milk production. A good supply of fresh water is vital for maximum milk production.

The most common type of milking parlor is the herringbone. Other types are the side-opening and carousel parlors. The carousel parlor is popular because it requires less labor. In a carousel parlor the cows are milked while they stand on a slowly rotating platform.

Handling manure on dairy farms is a major concern. A mature cow can produce up to 150 pounds of manure per day. Manure handling on the modern dairy farm is highly mechanized.

An effective herd health plan emphasizes the prevention of problems. Mastitis is a serious disease that affects dairy cattle. When infected with mastitis, the milk that a cow produces cannot be sold or consumed. Mastitis can cause permanent damage to the udder if not treated promptly.

To prevent bacterial growth, dairy farmers cool the milk to 45°F (4°C) and store it in bulk tanks at that temperature. Milk must not be allowed to warm up after it is cooled or else bacteria will grow in it, and the milk will spoil.

A dairy cooperative is a business that is owned, operated, and controlled by the dairy producers who are members. In the U.S., about 86 percent of milk is marketed through cooperatives.

Quick Facts

- Keeping good records is essential in dairy farming.
- Production records have helped dairy farmers make great strides in increased milk production.
- The modern dairy farm requires specialized buildings and equipment.
- The DHIA (Dairy Herd Improvement Association) is a major force in herd improvement.
- The two most common housing options for dairy farmers are the stanchion barns and free stall barns.
- Manure handling and disposal is a major concern on dairy farms.
- Almost all dairies use artificial insemination for breeding.
- Artificial insemination allows for rapid improvement in the genetics of the herd.
- The average gestation period for dairy cows is 283 days.
- Cows are ruminants, and their feed should be based on roughages.
- Dairy cows require about 20 gallons of water per day.
- A milking parlor is an area where cows are milked.
- A commercial dairy cow is usually milked twice daily.
- Milk is highly regulated to assure a fresh, wholesome product.
- Milk is fortified with vitamin D, vitamin A, and calcium to increase its nutritional value.
- A planned program of health care should be followed for the dairy herd.
- Mastitis is a serious disease that affects dairy cattle.
- After milking, the milk should be immediately cooled in bulk tanks to 45°F (4°C) to prevent bacterial growth.
- Cooperatives market most of the milk in the U.S.

Student Learning Activities

1. Prepare a bulletin board display of the parts of a dairy farm.
2. On a field trip to a local dairy farm, observe dehorning, hoof trimming, and other procedures related with maintaining dairy cattle.
3. Prepare a classroom display of roughages and concentrates used in dairy cow rations.
4. Send samples of forages to a laboratory for analysis.
5. Take a field trip to a local dairy farm in the area. Observe, take notes, and report on the kinds of facilities used.

Discussion Questions

1. Explain the steps that occur during the processing of milk.
2. Discuss why it is important for the producer to provide the best possible care for dairy cows.
3. Why is artificial insemination (AI) widely used on dairy farms?
4. Why is it important to feed dairy cows properly?
5. Why is it important to keep milk at a certain temperature?

Review Questions

True/False

1. Heredity does not affect the milk production of an individual cow.
2. In a dairy herd, 50% of the cows must be replaced each year.
3. Milk is tested for contamination before it leaves the farm.
4. Feed costs are about 25% of the total cost of producing milk.
5. Dairy cattle are not ruminants; therefore, roughage is not the basis for their feed.

Multiple Choice

1. Dairy cattle should be dehorned because:
 - a. horns can cause serious physical injury
 - b. horns are uncomfortable to the cow
 - c. horns reduce milk production
 - d. horns can cause disease

2. Dairy heifers are bred to calve at about _____ months of age.
 - a. 24
 - b. 19
 - c. 17
 - d. 15
3. A good record keeping system will indicate:
 - a. when a cow is expected to come into heat
 - b. health concerns for cows in the herd
 - c. how much feed is being used
 - d. all of the above
4. The most commonly used grain in dairy cattle rations is _____.
 - a. wheat
 - b. corn
 - c. oats
 - d. beans
5. A good body condition score for dairy cows is _____.
 - a. 1–2
 - b. 3–4
 - c. 5–6
 - d. 7–8

Completion

1. The most common milking parlor in current use is the _____.
2. The two most common types of dairy housing systems are the _____ and _____ barns.
3. High somatic _____ counts lower milk quality.
4. Cows that are not producing milk are referred to as _____ cows.
5. Calves should be fed _____ milk within a few hours after being born, and preferably in the first hour after birth.

Short Answer

1. Why is it important to manage dry cows effectively?
2. Name and define some of the common health ailments of dairy cows.
3. What are some problems caused by bacteria in milk?
4. Why is corn the most commonly used grain in dairy cattle rations?
5. Why is it necessary for dairy cattle to have adequate water in their rations?



CHAPTER 29

Selecting and Judging Dairy Cattle



OBJECTIVES

Upon the completion of this chapter, the student should be able to:

- Select desirable animals for dairy production.
- Identify the parts of a dairy cow.
- Explain the use of the PDCA Dairy Cow Unified Score Card.
- Evaluate dairy cattle.
- Use industry terminology and phrases to describe dairy traits.



KEY TERMS

pedigree
Purebred Dairy
Cattle Association
(PDCA)

Dairy Cow
Unified Score
Card

blind quarter

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Pedigree	Pedigree	Stammbaum	Pedigree	El Pedigrí
Score Card	Carte de pointage	Score-karte	Punteggio carta	La Tarjeta de Calificación
Udder	Mamelle	Euter	Mammella	La Ubre
Milk	Le lait	Milch	Latte	La Leche
Judge	Juge	Richter	Giudice	El Juez

Selection

The selection process for dairy cattle is based on the animal's physical appearance, health, milk production records, and pedigree. The physical appearance of a cow indicates her conformation, dairy strength, and ability to adequately support a good mammary system (Figure 29-1).

Milk production records help producers to evaluate how well each cow is doing compared to other cows, and how the farm average compares with other farms. Production records help predict the future of the animal's productive life and also help predict the production of the offspring over time. These records are the best estimate of the ability of a cow to produce milk.

The record of an animal's ancestors is the **pedigree**. The pedigree gives the name, registration number, type rating, production record, and show ring winnings of each ancestor for three or four

pedigree

a record of an animal's ancestry

FIGURE 29-1

A champion dairy cow. The physical appearance of this animal indicates good conformation and dairy strength.



Courtesy of Dr. D.J. Sheppard

generations. Good selection of animals for breeding based on animal evaluation and pedigree helps assure that the best genetics are included in the herd.

Purebred Dairy Cattle Association (PDCA)

an organization that sets the standards for various breeds of dairy cows

Dairy Cow Unified Score Card

a card that outlines the ideal standards for scoring a dairy cow

PDCA Score Card

The **Purebred Dairy Cattle Association (PDCA)** publishes a **Dairy Cow Unified Score Card** which describes the ideal cow and gives judges guidelines to follow. The score card was created for evaluating dairy cows. Each area of the score card allows for the assignment of points that, in the perfect cow, would add up to 100 (Figure 29-2).

did you know?

Dairy Judging is a popular event in both 4-H and FFA, as well as at the collegiate level. Dairy Judging teams travel frequently to competitions out of state and even to other countries to compete. Teams start as young as middle school.

A Dairy Judging event may consist of several components, including the placing of animals. The Dairy Judging classes consist of four animals to be ranked from best to worst. Contestants may also be asked to give oral reasons for their ranking of the animals in the class.

Description of the Score Card

A dairy judge must be familiar with the major trait divisions and the value of each division on the score card. The divisions on the score card are frame, dairy strength, rear feet and legs, and udder. Breed characteristics are listed on the score card and are important when judging the different breeds of dairy cattle.

Frame (15 Percent) Frame is described as the skeletal structure of the cow, other than the feet and legs. A total of 15 points out of 100 are available in this

A

DAIRY COW UNIFIED SCORECARD

Breed characteristics should be considered in the application of this scorecard

MAJOR TRAIT DESCRIPTIONS

There are four major breakdowns on which to base a cow's evaluation. Each trait is broken down into body parts to be considered and ranked.

1) Frame - 15%

The skeletal parts of the cow, with the exception of rear feet and legs. Listed in priority order, the descriptions of the traits to be considered are as follows:

Rump (5 points): Should be long and wide throughout. Pin bones should be slightly lower than hip bones with adequate width between the pins. Thurls should be wide apart. Vulva should be nearly vertical and the anus should not be recessed. Tail head should set slightly above and neatly between pin bones with freedom from coarseness. **Front End (5 points):** Adequate constitution with front legs straight, wide apart, and squarely placed. Shoulder blades and elbows set firmly against the chest wall. The crops should have adequate fullness blending into the shoulders. **Back/Loin (2 points):** Back should be straight and strong, with loin broad, strong, and nearly level. **Stature (2 points):** Height including length in the leg bones with a long bone pattern throughout the body structure. Height at withers and hips should be relatively proportionate. Age and breed stature recommendations are to be considered. **Breed Characteristics (1 point):** Exhibiting overall style and balance. Head should be feminine, clean-cut, slightly dished with broad muzzle, large open nostrils and strong jaw.

2) Dairy Strength - 25%

A combination of dairyness and strength that supports sustained production and longevity. Major consideration is given to general openness and angularity while maintaining strength, width of chest, spring of fore rib, and substance of bone without coarseness. Body condition should be appropriate for stage of lactation. Listed in priority order, the descriptions of the traits to be considered are as follows:

Ribs (8 points): Wide apart. Rib bones wide, flat, deep, and slanted towards the rear. Well sprung, expressing fullness and extending outside the point of elbows. **Chest (6 points):** Deep and wide floor showing capacity for vital organs, with well-sprung free ribs. **Barrel (4 points):** Long, with adequate depth and width, increasing toward the rear with a deep flank. **Thighs (2 points):** Lean, inclining to flat and wide apart from the rear. **Neck (2 points):** Long, lean, and blending smoothly into shoulders; clean-cut throat, dewlap, and brisket. **Withers (2 points):** Sharp with chine prominent. **Skin (1 point):** Thin, loose, and pliable.

3) Rear Feet and Legs - 20%

Feet and rear legs are evaluated. Evidence of mobility is given major consideration. Listed in priority order, the descriptions of the traits to be considered are as follows:

Movement (5 points): The use of feet and rear legs, including length and direction of step. When walking naturally, the stride should be long and fluid with the rear feet nearly replacing the front feet. **Rear Legs-Side View (3 points):** Moderate set (angle) to the hock. **Rear Legs-Rear View (3 points):** Straight, wide apart with feet squarely placed. **Feet (3 points):** Steep angle and deep heel with short, well-rounded closed toes. **Thurl Position (2 points):** Near central placement between the hip and pin bones. **Hocks (2 points):** Adequate flexibility with freedom from swelling. **Bone (1 point):** Flat and clean with adequate substance. **Pasterns (1 point):** Short and strong with some flexibility, having a moderate, upright angle.

4) Udder - 40%

The udder traits are evaluated. Major consideration is given to the traits that contribute to high milk yield and a long productive life. Listed in priority order, the descriptions of the traits to be considered are as follows:

Udder Depth (10 points): Moderate depth relative to the hock with adequate capacity and clearance. Consideration is given to lactation number and age. **Rear Udder (9 points):** Wide and high, firmly attached with uniform width from top to bottom and slightly rounded to udder floor. **Test Placement (5 points):** Squarely placed under each quarter, plumb and properly spaced. **Udder Cleft (5 points):** Evidence of a strong suspensory ligament indicated by clearly defined halving. **Fore Udder (5 points):** Firmly attached with moderate length and ample capacity. **Teats (3 points):** Cylindrical shape, uniform size with medium length and diameter; neither short nor long is desirable. **Udder Balance and Texture (3 points):** Udder floor level as viewed from the side. Quarters evenly balanced; soft, pliable, and well collapsed after milking. (Note: In the Holstein breed, an equal emphasis is placed on fore and rear udder (7 points each). All other traits are the same as listed above.)

TOTAL

Perfect Score

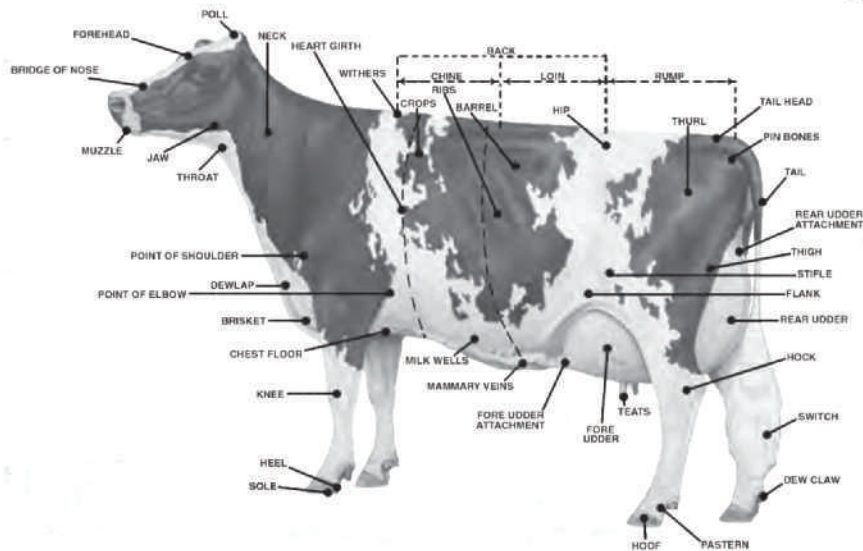
15

25

20

40

100



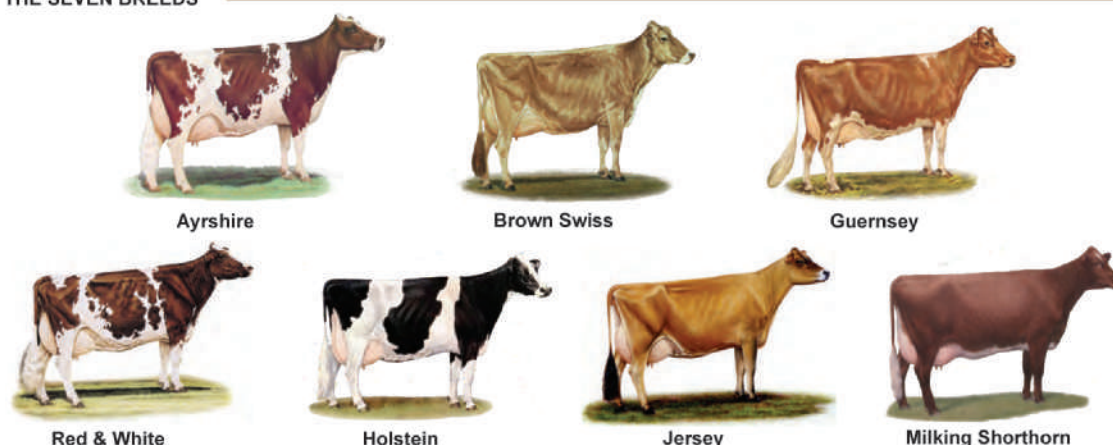
Copyrighted by the Purebred Dairy Cattle Association. 1943. Revised and copyrighted 1957, 1971, 1982, 1994 and 2009.

FIGURE 29-2

Purebred Dairy Cattle Association (PDCA) Scorecard.

B

THE SEVEN BREEDS



BREED CHARACTERISTICS

Except for differences in color, size, and head character, all breeds are judged on the same standards as outlined in the Unified Score Card. If any animal is registered by one of the dairy breed associations, no discrimination against color or color pattern is to be made.

Ayrshire Strong and robust, showing constitution and vigor, symmetry, style and balance throughout, and characterized by strongly attached, evenly balanced, well-shaped udder.

HEAD- clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw, large, bright eyes; forehead, broad and moderately dishd; bridge of nose straight; ears medium size and alertly carried.

COLOR- light to deep cherry red, mahogany, brown, or a combination of any of these colors with white, or white alone, distinctive red and white markings preferred.

SIZE- a mature cow in milk should weigh at least 1200 lbs.

Brown Swiss Strong and vigorous, but not coarse. Adequate size with dairy quality. Frailness undesirable.

HEAD- clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw, large, bright eyes; forehead, broad and slightly dishd; bridge of nose straight; ears medium size and alertly carried.

COLOR- body and switch solid brown varying from very light to dark; muzzle has black nose encircled by a white ring; tongue and hooves are dark brown to black.

SIZE- a mature cow in milk should weigh at least 1400 lbs.

Guernsey Strength and balance, with quality and character desired.

HEAD- clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw, large, bright eyes; forehead, broad and slightly dishd; bridge of nose straight; ears medium size and alertly carried.

COLOR- shade of fawn and white markings throughout clearly defined.

SIZE- a mature cow in milk should weigh 1200-1300 lbs.; Guernsey does not discriminate for lack of size.

FACTORS TO BE EVALUATED

The degree of discrimination assigned to each defect is related to its function and heredity. The evaluation of the defect shall be determined by the breeder, the classifier or judge, based on the guide for discrimination and disqualifications given below.

HORNS

No discrimination for horns.

EYES

1. Blindness in one eye: *Slight discrimination.*
2. Cross or bulging eyes: *Slight discrimination.*
3. Evidence of blindness: *Slight to serious discrimination.*
4. Total blindness: *Disqualification.*

WRY FACE

Slight to serious discrimination.

CROPPED EARS

Slight discrimination.

PARROT JAW

Slight to serious discrimination.

SHOULDERS

Winged: *Slight to serious discrimination.*

CAPPED HIP

No discrimination unless affects mobility.

TAIL SETTING

Wry tail or other abnormal tail settings: *Slight to serious discrimination.*

LEGS AND FEET

1. Lameness- apparently permanent and interfering with normal function: *Disqualification.*
- Lameness- apparently temporary and not affecting normal function: *Slight discrimination.*
2. Evidence of crampy hind legs: *Serious discrimination.*
3. Evidence of fluid in hocks: *Slight discrimination.*
4. Weak pastern: *Slight to serious discrimination.*
5. Toe out: *Slight discrimination.*

UDDER

1. Lack of defined halving: *Slight to serious discrimination.*
2. Udder definitely broken away in attachment: *Serious discrimination.*
3. A weak udder attachment: *Slight to serious discrimination.*
4. Blind quarter: *Disqualification.*
5. One or more light quarters, hard spots in udder, obstruction in teat (spider): *Slight to serious discrimination.*

Red & White Rugged, feminine qualities in an alert cow possessing adequate size and vigor.

HEAD- clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw, large, bright eyes; forehead, broad and slightly dishd; bridge of nose straight; ears medium size and alertly carried.

COLOR- must be clearly defined red and white; black-red and brindle is strictly prohibited.

SIZE- a mature cow in milk should weigh at least 1400 lbs. and be well balanced.

Holstein Rugged, feminine qualities in an alert cow possessing Holstein size and vigor.

HEAD- clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw, large, bright eyes; forehead, broad and moderately dishd; bridge of nose straight; ears medium size and alertly carried.

COLOR- black and white or red and white markings clearly defined

SIZE- a mature cow in milk should weigh at least 1400 lbs.

UDDER- equal emphasis is placed on fore and rear udder (7 points each), all other traits are the same as listed on the PDCA scorecard.

Jersey Sharpness with strength indicating productive efficiency.

HEAD- proportionate to stature showing refinement and well chiseled bone structure. Face slightly dishd with dark eyes that are well set.

COLOR- some shade of fawn with or without white markings; muzzle is black encircled by a light colored ring; switch may be either black or white.

SIZE- a mature cow in milk should weigh at least 1000 lbs.

Milking Shorthorn Strong and vigorous, but not coarse.

HEAD- clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw, large, bright eyes; forehead, broad and slightly dishd; bridge of nose straight; ears medium size and alertly carried.

COLOR- red or white or any combination (no black markings allowed).

SIZE- a mature cow in milk should weigh 1400 lbs.

6. Side leak: *Slight discrimination.*

7. Abnormal milk (bloody, clotted, watery): *Possible discrimination.*

LACK OF ADEQUATE SIZE

Slight to serious discrimination. (Note: Guernsey does not discriminate for lack of size.)

EVIDENCE OF SHARP PRACTICE

(Refer to PDCA Code of Ethics)

1. Animals showing signs of having been tampered with to conceal faults in conformation and to misrepresent the animal's soundness: *Disqualification.*

2. Uncalved heifers showing evidence of having been milked: *Slight to serious discrimination.*

TEMPORARY OR MINOR INJURIES

Blemishes or injuries of a temporary character not affecting animal's usefulness: *Slight to serious discrimination.*

OVERCONDITIONED

Slight to serious discrimination.

FREEMARTIN HEIFERS

Disqualification.

FIGURE 29-2 (Continued)

FIGURE 29-3

The frame of a dairy cow is important, not only to support body weight, but also to support the weight of the udder. This cow has a desirable dairy frame.



Delmar/Cengage Learning

category. The rump is the most important part of the frame, since it is most related to the support of the udder and to reproductive efficiency (Figure 29-3).

Dairy Strength (25 Percent) Dairy strength indicates the milking ability of the animal, along with strength that supports good milk production. This category is a combination of dairyness (production capacity) and body strength that will help the animal to be productive over several years. A total of 25 points out of 100 are available in this category.

Rear Feet and Legs (20 Percent) Rear feet and legs are given major consideration in evaluating dairy cows. Evidence of mobility and good feet and leg structure is vitally important (Figure 29-4). Back problems, among other problems, can occur if the cow does not have a structurally sound set of rear legs to support the udder (Figure 29-5). Full udders can weigh as much as 165 pounds (75 kg). As in other livestock, there needs to be adequate bone structure to support the animal's body. There are a total of 20 points out of 100 in this division.

Udder (40 Percent) The purpose of a dairy cow is to produce a high volume of quality milk. When selecting dairy cows, the udder is the most important trait (Figure 29-6). The producer wants



Courtesy of Dr. D.J. Sheppard

FIGURE 29-4

A good set of rear legs helps to support the body and udder.



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FIGURE 29-5

This cow's legs are too far underneath her, and she will probably have mobility issues later during her productive life.

FIGURE 29-6

This cow has an adequately formed udder. She should have a long and productive milking career unless other issues exist.



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FIGURE 29-7

This is a well-formed udder from the rear view.



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FIGURE 29-8

Side view of an improperly balanced udder. Notice how the front quarters and hind quarters are not level.

to make sure the animal has a well-formed udder with sufficient support that is solidly attached to the body (Figure 29-7). The udder must be large with uniformly sized teats and have balanced quarters, among other traits. A poorly formed or poorly attached udder will shorten the milking life of the cow (Figures 29-8, 29-9, and 29-10).



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FIGURE 29-9

Rear view of an improperly balanced udder. Notice how one side is much smaller than the other.



Courtesy of USDA

FIGURE 29-10

This udder does not have a good front (fore) attachment. The front of the udder does not blend smoothly into the underline.



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FIGURE 29-11

This cow has a blind (non-functional) quarter.

blind quarter

a quarter of the udder that no longer produces milk

A **blind quarter**, which is a quarter of the udder that no longer produces milk while the other quarters are lactating, is one of many faults that reduces the productivity of a cow (Figure 29-11). Forty points out of the 100 on the score card are given to the udder.

Judging Dairy Cattle

After studying the PDCA score card and gaining an understanding of the terminology and concepts, students should practice judging dairy animals. When judging, the animals should be first viewed from a distance. Animals should be viewed from the side, front, and rear. Handlers should make sure that their animal is on level ground while being judged. Handlers will move their animals around the show ring in a controlled manner while the judging is taking place (Figure 29-12). This allows the judge to evaluate the structure and mobility of the animal, the soundness of the udder, and the dairy strength of the animal.

It is important to take good notes about each cow. Notes should consist of identification points, desired traits and characteristics, and undesired traits and characteristics. Reason notes should be thorough enough so that it is easy to remember the class when it comes time to give reasons. When judging a class of dairy cattle, be sure to compare the animals not only to the ideal cow type, but also to the others in the class. This is helpful when giving oral reasons.



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FIGURE 29-12

This exhibitor is moving the dairy heifer around the ring, keeping a close eye on the judge.

Judging Example

Figure 29-13 shows a typical dairy cow that might be one of the four animals in a judging class. Although it is best to judge live animals, we can still tell a great deal about this cow. When looking for a good dairy cow, we are looking for one that will be productive in the herd for many years. This cow has a strong mammary system. It is held high above her hocks, smooth through the fore udder attachment, and has a lot of rear udder bloom. This cow is deep in her heart girth and on back through the barrel. Although we can only see this cow from the side, she appears to be a very powerful cow having pronounced dairy strength and is feminine through her head. Even though this cow cannot be viewed on the move, she has a correctly set pair of back legs and strong pasterns. Finally, this is a large-framed cow that is long from the muzzle to rump, and is tall from the ground to the withers. As for criticisms, there are three points that can be made from

the photo. The cow carries too much condition on her body and needs to be cleaner and leaner through her front end. Although it cannot be seen as easily from the side, the cow needs to exhibit more angulation and sharpness over her back. Finally, the cow's thurls could be more correctly set by not being as high in the pins. This cow could be a strong competitor in a class of four, depending on the other cows. Overall, this cow has very good traits and could be productive for several years.



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FIGURE 29-13

Cows are evaluated on dairy traits such as udder, dairy strength, rear feet and legs, and frame.

Dairy heifers have similar judging points as milk-producing dairy cows. The Dairy Cow Unified Score Card is used for heifers except for the section on udder traits. A judge should visualize how a heifer will develop as she matures.

Summary

Important factors in the selection of dairy cattle used for breeding and production are the physical appearance, milk production records, health, and pedigree of the animal.

Judging is based on comparing the dairy animal to the ideal dairy-type cow. The traits that are considered desirable are described by the Dairy Cow Unified Score Card. The score card is useful to students preparing for dairy cattle judging events and to others in the evaluation of dairy cows.

Traits emphasized on the score card are used in the selection of highly productive cows that can remain in the herd for several years. The score card places the most emphasis on the mammary system because it is the key to milk production. Although other areas such as rear feet and legs, frame, and dairy strength are important, they are given less weight.

When judging dairy cattle, look at the rear, front, and side view of the animal, and look for the traits described on the score card. It is important to take thorough notes, including identification points, good traits, and bad traits. Notes are helpful when preparing for oral reasons. Dairy terms should be used when preparing and giving oral reasons.

Quick Facts

- The selection process for dairy cattle is based on the animal's physical appearance, health, milk production records, and pedigree.
- The Purebred Dairy Cattle Association (PDCA) publishes the Dairy Cow Unified Score Card which describes the ideal cow.
- The major divisions on the PDCA score card are frame, dairy strength, rear feet and legs, and udder.
- In dairy judging, animals should be viewed from the sides, front, and rear.
- Good notes that include identification points, desired traits and characteristics, and undesired traits and characteristics should be taken to prepare for the presentation of oral reasons.

Student Learning Activities

1. Name the parts of the dairy cow using a live animal or picture.
2. Using live animals or pictures, judge a class of dairy cows or heifers.
3. Give oral reasons for which animal is best over a class of dairy cattle.
4. Have a local dairy producer come into the class and speak about classification of the herd.
5. Using the outline of a dairy cow, or drawing your own, label the parts of the cow.

Discussion Questions

1. Name the four things that can help when selecting dairy animals for breeding and production.
2. Why is judging dairy cows important?
3. Why is the Dairy Cow Unified Score Card important?
4. Explain the four divisions of the Dairy Cow Unified Score Card.
5. How is judging dairy heifers different from judging dairy cows? How is the judging similar?

Review Questions

True/False

1. Dairy character is not related to milking ability.
2. Judging dairy animals is not a process of comparing the individuals being judged with an ideal dairy type.
3. Defects are not important when judging cattle.
4. According to the Dairy Cow Unified Score Card, the mammary system is worth 40 percent.
5. The size of the udder is generally related to the milk-producing capacity.

Multiple Choice

1. What is the most appropriate way to view a dairy animal?
 - a. Front side
 - b. Rear side
 - c. Left side
 - d. Right side
 - e. All of the above
2. A quarter of the udder that has stopped producing milk is called a _____.
 - a. bound quarter
 - b. bound udder
 - c. dry quarter
 - d. blind quarter
3. The _____ gets the most points on the PDCA score card.
 - a. rear feet and legs
 - b. frame
 - c. udder
 - d. dairy character
4. A dairy cow's full udder can weigh around _____ pounds.
 - a. 165
 - b. 75
 - c. 130
 - d. 95
5. Heifers are judged the same as cows except for _____ traits.
 - a. rear feet and legs
 - b. udder
 - c. dairy strength
 - d. frame

Completion

1. An animal's ancestry is described in its _____.
2. _____ has the lowest percentage on the Dairy Cow Unified Score Card.
3. When judging heifers, the _____ does not carry the same points on the PDCA score card as when judging cows.

4. _____ are important when preparing to give oral reasons.
5. Dairy judging events are held at the collegiate level, as well as through the 4-H and _____.

Short Answer

1. What are some things to look for when judging a dairy animal?
2. Explain some of the characteristics of a high-producing dairy cow.
3. What does PDCA stand for and what does this organization do?
4. What are the four important factors in the selection of dairy cattle used for breeding and production?
5. What are some good strategies for giving oral reasons?



CHAPTER 30

Fitting and Showing Dairy Cattle



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Develop a plan to train a dairy heifer.
- Outline the basic care of a dairy heifer.
- Explain how to prepare for a dairy heifer show.
- Describe how to show a dairy heifer.



KEY TERMS

fitting
halter

pose
junior dairy show

open dairy show

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Health	Santé	Gesundheit	Salute	La Salud
Benefit	Avantage	Nutzen	Beneficio	El Beneficio
Rope	Corde	Seil	Corda	La Cuerda
Junior	Junior	Junior	Junior	El Joven

Introduction



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FIGURE 30-1

Students can learn valuable life skills showing animals.

fitting

the training and grooming of an animal in preparation for a show

halter

a rope, leather, or chain device with one loop placed behind the animal's ears and another loop around the nose for leading or restraining

Showing dairy animals provides students with important educational and personal development opportunities. The care, training, and showing of livestock helps to develop valued life skills such as becoming responsible, productive, and contributing citizens (Figure 30-1).

Fitting a Dairy Heifer for Show

In the show ring it will be evident to the judge which exhibitors have spent time with their calves and prepared adequately. These exhibitors will be able to control their show calves and display them to full advantage.

After obtaining a dairy calf, the exhibitor will need to teach the calf to tie, stand, and lead. **Fitting** includes training and grooming of the show animal.

Halter Training and Standing

The first step to training a dairy heifer is to place a **halter** on the head of the calf (Figure 30-2). It is best to start with a rope halter. A rope halter generally consists of two loops of rope, one loop behind the ears and the other loop around the nose, which are fastened to the heifer's head. The halter should fit properly on the calf's head to prevent injury and to allow for adequate control of the calf. Once the halter is placed on the calf's head, tie the heifer to a sturdy



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FIGURE 30-2

Rope halters should be fitted properly on the calf.

and stationary object, such as a post, in an area where the calf can safely pull and tug on the halter. Make sure to tie the heifer's head high enough so that she cannot get her feet tangled in the rope. Tie the animal for a few minutes at a time until the calf gets used to the halter and to being tied. Once the calf is accustomed to the halter and tying, the leading process can begin.

Training to Lead

The exhibitor should begin training the calf to lead by walking the animal for short periods of time, and gradually move up to longer periods. It is better to walk the calf for a short period of time daily rather than for long periods of time every few days. Daily walks help the animal become familiar with the exhibitor and become trained to lead (Figure 30-3). Train the animal to walk slowly with short steps and to hold its head up high. This is how the animals are presented in the ring. Exhibitors will need to train the calf to walk in a clockwise motion. A simple rope halter is good for everyday use, but the exhibitor should work the calf using a show halter for a few days before the show.

The exhibitor should walk on the left side of the animal at its head, holding the halter with the right hand, and close enough to have secure control of the animal (Figure 30-4). Exhibitors always remain on the left side of the animal, but may shift to the front

FIGURE 30-3

When training the calf to lead, use the same methods that are used in the show ring. Practice showing the calf with other students, so the calf will be comfortable in different situations.



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FIGURE 30-4

Exhibitors of dairy calves should always walk on the left side of animal.



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FIGURE 30-5

This student is training the dairy calf to pose. The student is pushing on the calf's shoulder to move its feet into place for judging.



Delmar/Cengage Learning

of the animal as necessary during the show. Dairy cattle exhibitors do not use a show stick like those used in showing other livestock.

Setting Up the Dairy Heifer

A dairy show calf should be taught to set-up or **pose**. When posing the animal, the front legs should be square and the hind leg nearest the judge should be positioned slightly farther back than other rear leg. It is important to be able to quickly get the show calf into place when posing (Figure 30-5). Teach the dairy heifer to position its feet by giving it a signal – putting pressure on the point of its shoulder with your hand (Figure 30-6 and Figure 30-7).

pose

positioning the animal to best show its traits

FIGURE 30-6

Once the calf becomes accustomed to being posed in a class, not as much pressure needs to be used. However, much practice is needed prior to the show.



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FIGURE 30-7

The exhibitor can use pressure on the front feet of the dairy calf to help pose the calf for the class.



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FIGURE 30-8

Washing is done at the farm before clipping, and at the show.

Preparation for the Show

The goal of all training is to prepare the show calf and exhibitor for the show ring. Spending plenty of time training and grooming will pay off at show time. The dairy heifer should be properly trained at home so that she is familiar with leading, tying, washing, grooming, and posing before she arrives at the show grounds.

Washing

Heifers should be washed at home and also at the show (Figure 30-8). When washing the animal, use a shampoo specifically designed for livestock and a soft brush to clean the animal. Make sure all dirt and debris is removed from the hair coat. Also, make sure the heifer is washed in areas that are easily missed, such as the underline and under the legs. When washing the head, it is important to make sure that no water gets into the heifer's ears. The ears should be cleaned with a towel, and water or rubbing alcohol, to remove wax build-up and dirt.

Brushing

Show heifers should be brushed at least once a day with a soft brush. Brushing the heifer everyday helps keep the hair coat clean and makes it easier to clip. Calves that have been brushed regularly will look better on show day.

Trimming Hooves

Properly trimmed hooves are important for show calves. When the hooves get too long and are not shaped properly, it can take away from the appearance of the calf and affect the way it walks. The hooves should be trimmed during the early conditioning period. Make sure that hooves are trimmed at least two weeks before the show. This will give the calf time to recover if the person trimming gets too close to the living tissue, which can cause the calf to limp. Hoof trimming should be done by someone who is experienced in hoof care.

Checklist for the Show

Inexperienced exhibitors can easily become overwhelmed by all the preparation needed for the show. A list of items to take to the show makes the task manageable.

- ▶ Feed – make sure to take enough for the entire show. Include special show feeds like beet pulp.
- ▶ Health Certificate – a health certificate from a veterinarian must accompany the dairy heifer to the show.
- ▶ Entry Forms – Make sure all entry forms are submitted by the due date to the appropriate authority.
- ▶ Show Box with:
 - brushes and combs
 - stall cleaning equipment (forks, brooms, shovels, etc.)
 - tie-halter for each animal plus one extra halter
 - show halter(s)
 - blow dryer
 - towels
 - clippers
 - grooming aids, including shampoo and other treatments
- ▶ Show Clothes – white clothing is required at most dairy shows (Figure 30-9)
- ▶ Water and feed pans
- ▶ Fan



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FIGURE 30-9

Exhibitors should wear clean white clothing when showing a dairy animal. A professional appearance in the show ring reflects well on the exhibitor and the school.

PDCA Fitting and Showing Score Card

Exhibitors and advisors should make themselves familiar with the breakdown of points contained in the Purebred Dairy Cattle Association (PDCA) Uniform Fitting and Showing Score Card. These points are

used for judging junior dairy fitting and showmanship contests. This score card is used to assign point scores to exhibitors and dairy heifers in both fitting and showmanship classes.

The categories on the PDCA Uniform Fitting and Showing Score Card are:

- ◀ Appearance of Animal – 30 points
 - Cleanliness – 10 points
 - Grooming – 10 points
 - Clipping – 5 points
 - Condition and Thriftiness – 5 points
- ◀ Appearance of the Exhibitor – 10 points
- ◀ Showing Animal in the Ring – 60 points
 - Leading – 25 points
 - Posing the Animal – 15 points
 - Show the Animal to Its Best Advantage – 10 points
 - Poise, Alertness, and Attitude – 10 points

The following website should be checked to obtain the latest and most current version of the PDCA Uniform Fitting and Showing Score Card: <http://www.wipdca.com>.



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FIGURE 30-10

Beginner exhibitors should have someone experienced help them to clip their calves, especially the topline.

Clipping and Fitting Dairy Cattle

Dairy cattle should be clipped before the show. Most of the clipping should be done at home. This makes clipping less stressful on both the exhibitor and the show calf (Figure 30-10). Clipping a dairy animal should be done by the exhibitor with the advisor's help as needed.

The show calf should be dry, clean, and free of debris. Before starting to clip or groom the show calf, the calf should be tied to a sturdy post or put into a blocking chute. A blocking chute is highly recommended.

The whole body of the animal will need to be clipped before showing. Some exhibitors will clip

junior dairy show

a dairy show that only allows young competitors in 4-H or FFA to compete

open dairy show

a dairy show that allows participants of any age to compete



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FIGURE 30-11

Calves should be trained to hold their heads up in the show ring. Hold the halter close to the calf's face to encourage this behavior.



Courtesy of Christy Bryan

FIGURE 30-12

Exhibitors should keep the dairy calf's head up, and move at a slow and steady pace around the show ring.

all of the calf's hair except the topline and tail areas. The topline of the heifer is clipped to make the back look straighter. Advisors or experienced handlers will usually clip or assist with clipping the topline. Beginners should never start a clipping or fitting job without an experienced adult to supervise.

Showing Dairy Cattle

Junior dairy shows and most open dairy shows usually have fitting classes and showmanship classes. Junior dairy cattle shows are shows that only allow young competitors in 4-H or FFA to show. These exhibitors can be as young as nine years old, and as old as 18 or 19 (high school students). **Open dairy shows** are shows in which there is no restriction on the participant's age; children, adolescents, and adults are allowed to show. Most competitors in open events have years of showing experience, and are considered by many to be professional exhibitors.

Showmanship

Before entering the show ring, the exhibitor and their animal should look their best. The exhibitor should be dressed in a clean white shirt and pants. The dairy heifer should be clean, dry, and fitted for the show. When entering the show ring, keep the head of the heifer held up (Figure 30-11). Most judges prefer a slow and steady pace when walking the dairy heifer (Figure 30-12).

Enough space should be allowed between heifers so that the judge can clearly view an exhibitor and his or her calf from the side. It is important to keep eye contact with the judge at all times. The exhibitor should be focused in the ring and ignore all outside distractions. The judge will usually use hand signals to select a calf and indicate movement of the cattle. If the exhibitor is not paying attention, he or



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FIGURE 30-13

Exhibitors should learn to avoid outside distractions. They should concentrate on their calf and the judge.

she could miss the selection signal. After the judge has evaluated the class, he or she will start to select the placings. The exhibitor should pay close attention, watching for signals from the judge. Exhibitors should continue to show until exiting the show ring (Figure 30-13).

Exhibitors should be courteous inside and outside of the show ring. They should strive to be good representatives of their school and community.

Showmanship Questions

Exhibitors are often asked questions by the judge during the showmanship event. Each exhibitor should be ready to answer questions (Figure 30-14). Some of the more basic questions are:

- What is the weight of your heifer?
- When was your dairy heifer born?
- What is the breed of your heifer?
- What do you think is the best quality of your heifer?
- What do you think is the weakest characteristic of your heifer?



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FIGURE 30-14

Exhibitors showing calves in the showmanship event should be prepared to answer basic questions about their calves.



Delmar/Cengage Learning

FIGURE 30-15

Showing dairy cattle should be fun, as well as a learning experience. The judge and audience like to see exhibitors that look like they enjoy the activity.

More in-depth questions may come from the following areas:

- Qualities of dairy heifers
- Internal/external parasites
- Breeds and genetics
- Identification
- Feeds and feeding
- Animal part identification
- Market identification
- Production
- Milk

Exhibitors should answer questions honestly and not become upset if they cannot answer a question. Participating in a livestock show should be fun as well as educational. Remember to smile and enjoy the experience (Figure 30-15).

Summary

Exhibitors gain life skills through showing dairy cattle. Junior dairy cattle show events teach responsibility, communication, patience, and other important qualities. The first step in getting a heifer ready for a show is training the heifer. The training process involves getting the heifer used to a halter, teaching her to lead, teaching her to pose, and preparing her for the ring. It is important to care for the heifer everyday, washing occasionally and brushing on a regular basis. Washing makes clipping easier. Clipping helps make the animal look her best on show day. When clipping for show day, it is important to understand how to properly clip a calf. It is best to have the assistance of a person experienced in clipping and fitting to help beginners. Hooves should be trimmed by an experienced person before the show. When preparing for a show day, the exhibitor should have a list of items to take to the show. The PDCA Uniform Fitting and Showing Score Card gives a basic understanding of what the judge is looking for in the ring. The exhibitor should be able to answer the judge's

questions about his or her calf. Once the heifer is properly prepared and ready to show, it is the exhibitor's job to present the heifer and himself or herself to the best advantage.

Quick Facts

- Exhibitors who spend time practicing with their calf prior to show day are rewarded in the show ring.
- Halter training is the first step to training the show calf.
- The calf should be taught how to lead. Walking the calf everyday is important.
- Exhibitors must keep their calves' heads held high during training and in competition.
- The calf must be taught to pose and hold the pose for the judge in the show ring.
- Dairy calves are shown by walking clockwise around the ring.
- A well-fitted calf is one that has been washed, had its hair coat brushed, and had its hooves and hair properly trimmed.
- The PDCA Uniform Fitting and Showing Score Card is used as a basis for assigning points in dairy cattle shows.
- Exhibitors entering showmanship classes should be able to answer the judge's questions about their calves.
- The exhibitor should walk on the left side of the dairy calf.

Student Learning Activities

1. Name the parts of the PDCA Uniform Fitting and Showing Score Card.
2. If available, use student project heifers to demonstrate showing techniques.
3. Watch a video about showing dairy cattle and discuss the techniques.
4. Have an experienced exhibitor speak to the class about showing dairy cattle.
5. Use the information given in this chapter when planning and participating in a supervised agricultural experience program in dairy.

Discussion Questions

1. What personal qualities can junior exhibitors gain from showing dairy cattle?
2. Describe the process for training a dairy heifer for show.
3. Why is it important to wash and brush a dairy heifer for show day?
4. Discuss the importance of trimming hooves.
5. List five questions that the judge might ask during the showmanship event.

Review Questions

True/False

1. The exhibitor and the heifer should be clean and well-groomed when entering the show ring.
2. When positioned for the judge, the heifer's rear leg closest to the judge should be slightly pulled forward.
3. The exhibitor should stand on the left side of the dairy heifer.
4. The exhibitor should keep eye contact with the judge at all times.
5. The exhibitor can quit showing as soon as he or she has been placed.

Multiple of Choice

1. Which of the following should be brought to a show?
 - a. Show halter
 - b. Health papers
 - c. Brushes
 - d. All of the above
2. Which section of the PDCA Uniform Fitting and Showing Score Card has the highest point value?
 - a. Grooming
 - b. Clipping
 - c. Showing the animal in the ring
 - d. Appearance of animal

3. A type of dairy show that adults and young adults can enter is called a/an _____ show.
 - a. mature
 - b. adult
 - c. regulation
 - d. open
4. The inside of the ears of a dairy heifer should be cleaned:
 - a. with a damp cloth or a cloth and alcohol.
 - b. by spraying them with a hose.
 - c. with a stiff brush.
 - d. with a cotton swab.
5. Handling a dairy calf _____ prepares the calf and the exhibitor for the show ring.
 - a. every other day
 - b. everyday
 - c. twice per week
 - d. three times per week

Completion

1. The _____ of the heifer is clipped to make the back look straighter.
2. A dairy exhibitor should walk at a _____ and steady pace in the ring.
3. The two parts of a junior dairy cattle show are the fitting and _____ classes.
4. It is highly recommended that dairy calves be restrained in a _____ for clipping.
5. The head of the dairy heifer should be held _____ when entering the show ring.

Short Answer

1. What are the parts of the training process?
2. What group publishes the Uniform Fitting and Showing Score Card?
3. List the three categories of the Uniform Fitting and Showing Score Card.
4. List five items that exhibitors should bring to the show.
5. Describe the correct posing of a dairy calf for the judge.



Section 10

COMPANION ANIMALS

CHAPTER 31 Introduction to Companion Animals

CHAPTER 32 Dogs

CHAPTER 33 Cats

FFA AND 4-H CONNECTION



The following is a partial list of activities in which a student may participate using knowledge obtained from a companion animal program. Students should consult local and state youth organizations, such as FFA and 4-H, to determine which programs are available in their area.

- Agricultural Sales
- Agriscience Fair
- Animal Nutrition
- Dog and Cat Shows
- Small Animal SAE (Supervised Agricultural Experience)
- Veterinary Assisting

Proficiency Awards (FFA)

- Agricultural Sales
- Small Animal Production and Care
- Specialty Animal Products
- Veterinary Medicine





CHAPTER 31

Introduction to Companion Animals

OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Explain the difference between a companion animal and a production animal.
- Describe the six basic types of companion animals.
- Outline the basic care requirements for a companion animal.
- Discuss the laws and interest groups that focus on companion animals.

KEY TERMS

companion
animal
cycle
protein skimmer
nocturnal
reptile
amphibian
carnivore
herbivore

omnivore
folivore
insectivore
salmonella
maintenance cost
flea dirt
pedigree
limited admission
shelter

euthanasia
open admission
shelter
spay
neuter
feral
animal welfare
animal rights

LANGUAGE CONNECTION

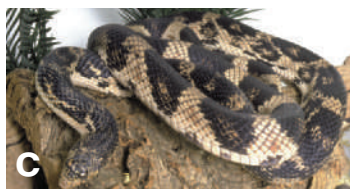
English	French	German	Latin	Spanish
Companion	Compagnon	Begleiter	Adsectator	El Compañero
Fish	Poisson	Fisch	Piscis	La Pez
Bird	Oiseau	Vogel	Avis	La Ave
Snake	Serpent	Schlange	Serpens	El Serpiente

companion animal

an animal kept for enjoyment and companionship in a close daily relationship with humans; a pet

What is a Companion Animal?

A **companion animal** is any animal kept as a household pet or in a close daily relationship with humans to provide enjoyment and companionship. In contrast to production animals, companion animals are kept solely for the pleasure they give their owner, although businesses involving their production, care, and related occupations can be very profitable. Companion animals are very popular in wealthier nations such as the United States, where more households have disposable income that can be spent on companion animals. In fact, 63% of American households own at least one pet compared to only 14% of households in Tanzania, a developing country with much lower per capita income. Companion animals can range from small animals, such as hamsters and cats, to more exotic animals, such as snakes and parrots (Figure 31-1).

**A****B****C****D****FIGURE 31-1**

People keep a wide variety of animals as companion animals: (A) cat (B) hamster (C) snake (D) parrot.

Sources: A: Eric Isselée, 2012. Used under license from Shutterstock.com; B: Eric Isselée, 2012. Used under license from Shutterstock.com; C: Courtesy of Isabelle Franscais; D: Justin Black, 2012. Used under license from Shutterstock.com

Companion animals are valued for their ability to be domesticated, or have comfortable and safe interactions with humans. Some animals, such as tigers, chimpanzees, and snakes, are incapable of being completely domesticated, but many people still keep them as pets.

Types of Companion Animals

There are six basic types of companion animals: dogs, cats, fish, small mammals, birds, and reptiles and amphibians. These groups vary widely in their needs, care, and usefulness as a companion for humans.

Dogs

Dogs are one of the most common types of companion animals, due in part to their friendly personalities, loyalty to their owners, and their ability to safely and comfortably interact with humans. Although there are more cats in the U.S. than dogs, a higher percentage of households have a dog than a cat, or any other pet.

Dogs come in many different breeds, sizes, and temperaments. A person wishing to have a dog will find breeds adapted to a variety of housing, lifestyles, and locations. Small dogs are ideal for people living in apartments or cities. Large dogs are better suited for houses with large yards and rural areas, where the dogs have more freedom to exercise. Dogs are often used as service animals, such as guide dogs for the blind, police dogs, and dogs that provide therapeutic services in hospices and nursing homes (Figure 31-2). Dogs will be covered in more detail in chapter 32 of this text.



©Stockphoto/Wesley Pott

FIGURE 31-2

Emergency services and law enforcement train dogs for services such as search and rescue.



Delmar/Cengage Learning

FIGURE 31-3

Cats are a popular choice for companion animals.

Cats

Based on the total number of animals owned, cats are the most popular pet in the U.S. (Figure 31-3). Cats are much more self-serving and independent than dogs, which is why they require less

maintenance and attention. Although cats are less sociable than dogs, they can be highly enjoyable companion animals. Like dogs, cats require proper care. Cats should be groomed, fed, provided with fresh, clean water, clean litter boxes, and taken to the veterinarian on a regular basis to ensure good health. Cats will be covered in detail in chapter 33 of this text.

Fish

After dogs and cats, fish are the next most popular choice for household pets. Fish can be an attractive and enjoyable addition to the home. Fish come in a wide variety of species, many of them bright and colorful. Because many species of fish do not live well together, it is best to research the habits, likes, and dislikes of each species before purchase. Fish tanks, both freshwater and saltwater, require a lot of maintenance. The estimated costs for setting up freshwater and saltwater aquariums are shown in Table 31-1.

Before purchasing the fish, the aquarium must be **cycled**. After the aquarium has all the components in place, such as the water, heater, plants, gravel, and decorations, the water must circulate through the filters. The complete cycling process can take 2 weeks to 2 months to complete. During this time, beneficial bacteria will be established and contaminants, such as chlorine and ammonia, will dissipate.

Most fish, especially saltwater species, require fish tanks with specialized equipment. One piece of equipment used primarily for the saltwater aquarium is a **protein skimmer**. A protein skimmer helps to remove the dissolved organic compounds and other harmful substances that can cause problems with algae and upset the pH balance.

The temperature of the water, especially in a saltwater aquarium, must be carefully regulated, as well as the ammonia and nitrate levels. A saltwater tank is more difficult to maintain than a freshwater tank

cycle

to circulate the water in an aquarium with all filters and components in place for a period of time before fish are added

protein skimmer

a device used in an aquarium to remove harmful compounds and substances that can cause algae growth or upset the pH balance in the tank

TABLE 31-1

Costs for Setting Up an Aquarium

Freshwater Tank	
Aquarium (29 gallon)	\$50
Gravel	\$20
Filter (Power filter)	\$50
Light	\$50
Test kits (pH, ammonia, etc.)	\$50
Food, nets, scrapers, other equipment	\$25
<i>Total cost</i>	\$245 + cost of fish
Saltwater Tank	
Aquarium (29 gallon)	\$50
Sand	\$50
Filter	\$25
Power heads for water movement	\$50
Protein skimmer	\$150
Hydrometer	\$10
Salt mix	\$30
Live rock	\$100
Test kits (pH, ammonia, etc.)	\$70
Lights	\$50
Food, nets, scrapers, other equipment	\$25
<i>Total cost</i>	\$560 + cost of fish

because of the need for more exact temperature and chemical regulations. See Figure 31-4 for a photo of a typical saltwater aquarium.

Overfeeding of fish must be avoided, as the left-over food will become trash in the tank and increase the ammonia level of the water. Ammonia is toxic to fish, and the higher the level of ammonia, the more likely the fish are to die.

FIGURE 31-4

A saltwater tank is very colorful but more difficult to maintain than a freshwater tank.



Fish filter oxygen from the water through their gills. An air pump maintains appropriate oxygen levels in the water and circulates oxygen throughout the tank. A water filter helps keep the water clean by siphoning out any impurities that may be harmful to the fish. It is important to clean the filter and the fish tank on a regular basis to maintain the health of the fish and their environment.

Small Mammals

The most common small mammal pets are gerbils (which have soft tails), hamsters (which have small or no tails), rats, mice, guinea pigs, ferrets, and rabbits (Figure 31-5). There are also more exotic small mammals that are kept as pets, such as sugar gliders and hedgehogs. Some of these small pets can never be fully domesticated, and some may bite when handled by humans. Small mammal pets require special facilities and food sources to meet their daily needs.

A prospective owner of a small mammal should do adequate research before purchasing the pet. For example, rodents such as hamsters and guinea pigs require cages that provide ample space, are lined with a soft, absorbent bedding material, and have adequate exercise equipment, such as a wheel for

FIGURE 31-5

A teddy bear hamster.



Courtesy of Shannon Lawrence

running. Cages with many tubes and tunnels not only cost more, but are more difficult to clean. Like rodents, rabbits require cages with plenty of space to move around, sleep, and eat. All cages and facilities should be cleaned on a regular basis. Rodents like to hide and sleep, so they should be provided with a dark shelter.

Rodents are typically fed a pre-prepared mix of seeds and grains. Fresh food such as apples and spinach are recommended for some rodents. Rabbits need a mix of grass, hay, and fresh food. Fresh food ideal for rabbits includes lettuce, spinach, carrots, and green peppers. As with most animals, commercially prepared diets are available for rabbits. These feeds usually come in pelleted form.

Sugar gliders are becoming more popular as pets in states where they have been legalized (Figure 31-6). Pet owners should realize that sugar gliders are **nocturnal**. Nocturnal animals sleep during the day and are active at night.

nocturnal

an animal that is active at night and sleeps during the day

Birds

Birds can make great household pets and typically require less attention, maintenance, and care than other companion animals. Birds come in a variety of species and sizes. Popular household species include

FIGURE 31-6

Sugar gliders.



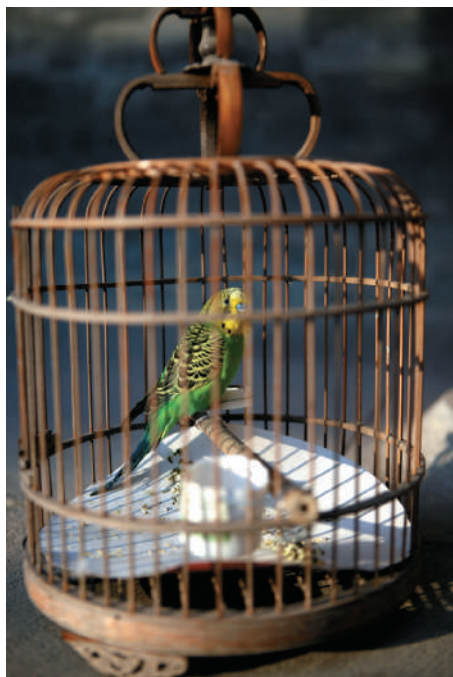
canaries, parakeets, cockatiels, lovebirds, and parrots. Canaries enjoy the company of other canaries and require the least human interaction of the household birds. Parakeets are highly intelligent and will easily bond with their owners. Cockatiels and lovebirds tend to be very social, often forming affectionate bonds with owners. Parrots, including the African gray pictured in Figure 31-7 and the macaw, are considered to be the most intelligent of household birds. Some parrots have vocabularies of more than 2,000 words! Parrots are also very social and will often demand attention from their owners.

Parrots can live up to 50 years or longer in captivity. Most birds can live 10 years or more with proper nutrition and care. There is a longer commitment that needs to be considered before the purchase of a pet bird, because of its longer lifespan. A prospective owner should consider how a bird will fit into his or her current or future lifestyle.

All household birds require maintenance and care. Smaller birds, such as canaries and cockatiels, are happy in smaller cages that can be placed comfortably in the corner of a room (Figure 31-8). Larger birds, such as parrots, require more spacious cages. Most pet birds enjoy a diet of seeds and roughage such as fruits and vegetables. However, some seeds and other foods are toxic to birds. It is important for owners to be aware of what their bird consumes.

**FIGURE 31-7**

African Gray parrots.



©iStockphoto/dhumi4691

FIGURE 31-8

Birds should be kept in cages based upon their size.

reptile

a cold-blooded vertebrate has clawed toes and is covered with scales or plates; includes turtles, snakes, lizards, alligators

amphibian

a cold-blooded, smooth and moist-skinned vertebrate without clawed toes; includes salamanders, toads, and frogs

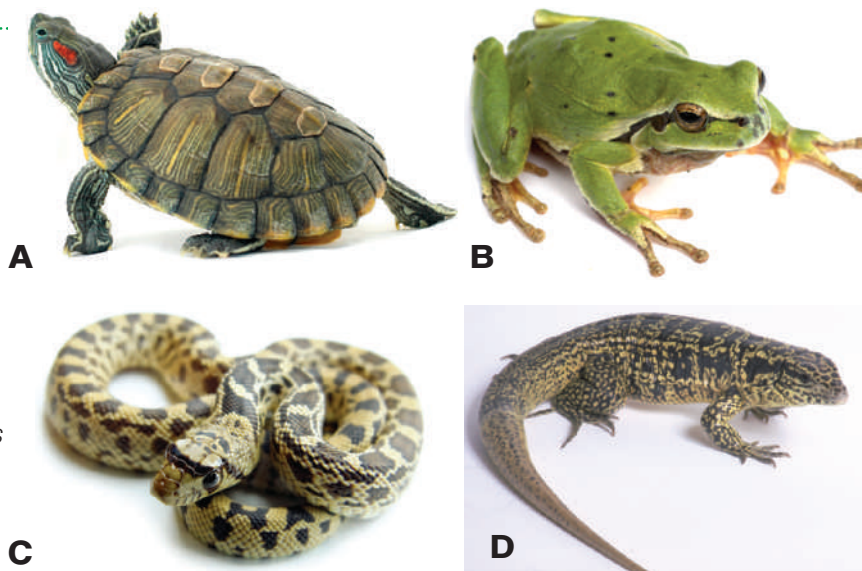
Toxic foods include chocolate, avocado, apple seeds, and tomato leaves. Birds tend to be messy pets, leaving their feathers and feces around the house and in the cage. A bird's cage should be cleaned at least once a day. Good sanitation practices should be followed to prevent the spread of diseases, such as salmonella. Thoroughly wash hands before and after handling birds and their wastes.

Reptiles and Amphibians

Common reptiles and amphibians kept as household pets are lizards, snakes, frogs, salamanders, and turtles (Figure 31-9). **Reptiles** include alligators, turtles, and snakes. **Amphibians** include salamanders, toads, and frogs. Although reptiles and amphibians have many similarities, one difference is the structure of their skin. Reptiles are covered with scales, shields, or plates, and their toes have claws. Amphibians have moist, glandular skin, and their toes lack claws.

Reptiles and amphibians are kept in terrariums, which are regulated for heat and light. The terrarium ideally includes plants found in the species' natural environment. Maintaining a terrarium can be expensive due to the specialized equipment needed to provide the proper amount of light and heat.

As with any pet, before buying a pet reptile or amphibian, it is important to research and be aware

**FIGURE 31-9**

People may keep reptiles or amphibians as pets: (A) turtle (B) frog (C) snake (D) lizard.

Sources: A: Snowhite, 2012. Used under license from Shutterstock.com; B: TSOMBOS Alexis, 2012. Used under license from Shutterstock.com; C: forestpath, 2012. Used under license from Shutterstock.com; D: werg, 2012. Used under license from Shutterstock.com

carnivore

an animal that primarily eats meat

herbivore

an animal that eats plants as the main part of its diet

omnivore

an animal that primarily eats both meat and plants

folivore

an animal that only eats leaves

insectivore

an animal that only eats insects

salmonella

a bacterium that causes gastrointestinal illness in humans

of the specific needs and care requirements of that species. The different species of reptiles and amphibians have different care requirements. Generally, the various species of reptiles and amphibians should not be mixed in a terrarium.

The feeding preferences of reptiles and amphibians vary widely. **Carnivores**, like snakes, primarily eat raw meat from small animals such as mice, rats, fish, birds, and bird eggs. Pre-killed animals are available for owners of carnivorous reptiles. **Herbivores**, like tortoises, eat only vegetation. **Omnivores**, like many aquatic turtles, will eat both animal and plant material. There are also many species that eat a highly specialized diet. **Folivores**, like iguanas, eat only leaves. **Insectivores**, like chameleons, eat only insects. It is important to be aware of the eating habits of different species before buying a pet. For example, someone who is uncomfortable feeding live mammals, such as mice and rabbits, to a python should consider buying a different pet.

There are many problems associated with reptile and amphibian ownership. Some reptiles, such as venomous snakes and some constricting snakes, are illegal pets in many states. It is important to review pet ownership laws before purchasing any animal, especially reptiles. Another problem associated with the ownership of reptiles and amphibians as pets is the risk of **salmonella**, a bacterium that causes stomach and intestinal (gastrointestinal) illness in humans. Most reptile species, and many amphibian species, are natural carriers of salmonella in their intestinal tract. Salmonella can be transmitted directly by handling a reptile, or indirectly by coming in contact with water or surfaces that are contaminated. The salmonella will not cause any illness in reptiles, but it can cause serious illness in people. Children and adults with weakened immune systems should avoid all contact with reptiles and amphibians. Everyone should take specific precautions, such as hand washing after handling an animal, to avoid salmonella infection.

Responsibility of Owning a Companion Animal

Although owning a companion animal is very popular, especially among Americans, pet ownership requires a great deal of time and responsibility. Most companion animals require daily feeding, grooming, affectionate attention, and cleaning of their housing facilities. Many pets also need adequate training to adapt to a domesticated lifestyle. This training can sometimes be frustrating and requires a lot of time and patience. Training can include teaching a puppy to go outside to use the bathroom, teaching a kitten to use a litter box, and training a dog to walk on a leash.

Most companion animals need a sufficient amount of human interaction, especially if there are no other pets in the household. Social interaction is important because it helps an animal to adapt to a domesticated lifestyle. More sociable animals, such as dogs, typically demand more attention from their owners, but almost all companion animals enjoy human interaction. A pet owner must be willing to devote time each day playing with his or her pet and giving it affectionate attention (Figure 31-10).



FIGURE 31-10

It is important to be able to spend adequate time and provide attention to pets.

maintenance cost

the amount of money required for the care and upkeep of an animal

Potential owners should be aware of the **maintenance costs** of a pet. Pet ownership can be very expensive. The cost of owning a dog averages over \$100 per month.

**Math Connection**

Each factor below should be considered in estimating the cost of pet ownership.

- ▶ Cost of the animal
- ▶ Feed, treats, special diet
- ▶ Fencing, cage
- ▶ Bedding
- ▶ Housing/shelter
- ▶ Boarding
- ▶ Grooming, grooming aids, and cleaning supplies
- ▶ Veterinary care
- ▶ Monthly medications (heartworm preventative, flea medicines, etc.)

Americans spend over \$40 billion per year on pet products and services, and that amount continues to increase. In fact, more money is spent each year on pet food than baby food.

**Health Concerns
with Companion Animals**

There are health concerns and risks that affect most companion animals. Before purchasing a pet, people should be well aware of its health maintenance needs and the diseases to which the animal is most susceptible. It is the owner's responsibility to be well-informed of his or her pet's health care needs.

One of the most common health concerns for companion animals is external parasites, especially fleas and ticks. Fleas and ticks can infest dogs, cats, small mammals, and even birds.

The life cycle of the flea is fairly complex, making complete elimination a flea infestation difficult. See Figure 31-11 for a diagram of the life cycle of the flea. The first stage of the flea life cycle is the egg. The adult female flea can lay up to 50 eggs per day. Although the eggs are laid in the fur of the host animal, the eggs typically fall to the ground or carpet. The hatching of the eggs typically occurs between two days and two weeks, but the time can vary, depending on environmental conditions. The second stage is the larva. During this stage, the flea larvae actively move around and eat the feces of adult fleas, which consists mainly of dried blood. The larvae also eat other organic debris found in carpet or bedding. The adult's feces are also known as **flea dirt** and can often be found in the hair of a heavily infested animal. Flea dirt looks like coarsely ground pepper and is reddish in color when smeared on white paper. The

flea dirt

the feces of the adult flea

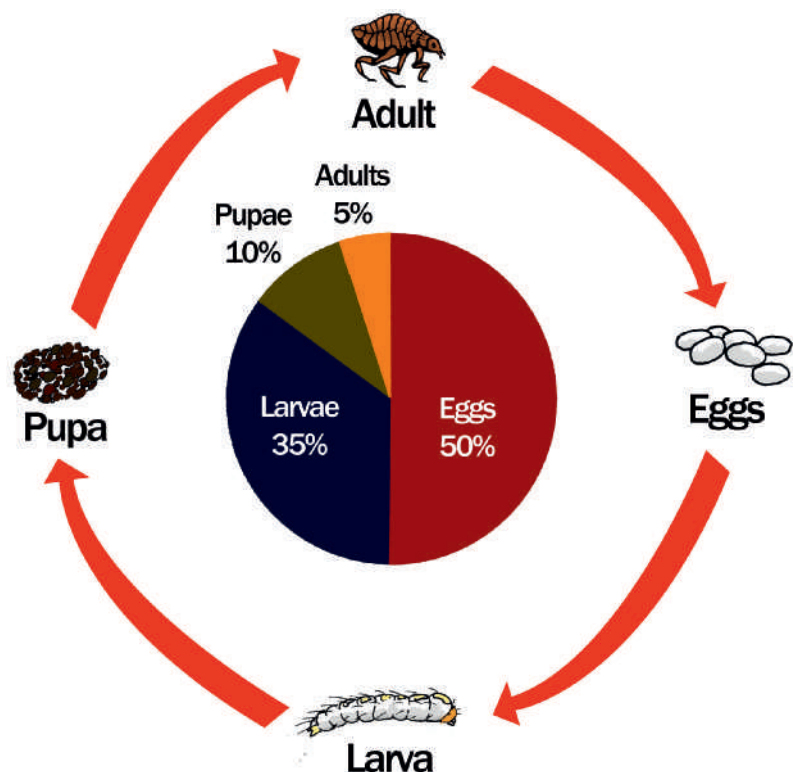


FIGURE 31-11

Life cycle of the flea.

third stage of the flea life cycle is the pupa. A larva will spin a silk cocoon and pupate, waiting for the right time to emerge from the cocoon. The pupal stage can last for a year or more until the adult flea emerges. Conditions that may cause a flea to emerge from its cocoon include temperature, humidity, and carbon dioxide given off by a potential host. The final stage of the life cycle is the adult. The adult flea usually lives on the animal, and its diet consists of blood from this host animal. Adult fleas are also known for their impressive jumping abilities.



Math Connection

An adult flea can jump about 12 inches vertically and about 16 inches horizontally – almost 200 times its body length! If you could jump 200 times your body height, how high could you jump?



Science Connection

Fleas and ticks are attracted to carbon dioxide (CO_2), a gas given off during animal respiration. They can detect the presence of an animal, and possible meal of blood, by the sudden presence of CO_2 in the air given off by the animal. Fleas will jump toward a stimulus such as CO_2 and movement, trying to grasp onto the animal. Ticks will hang motionless on weeds and shrubs until they are attracted by motion and the CO_2 given off by an animal. They will then try to attach themselves as the animal passes by.

Breaking the flea life cycle is the key to eliminating a flea infestation. Only about 5% of fleas are in the adult stage at any one time. Pets should be treated with flea control products at the first sign of fleas,

**FIGURE 31-12**

Lyme disease can be caused by the bite of a tick.

to kill any fleas in the adult stage. If multiple pets are present, all pets should be treated at the same time. The majority of fleas are in the larvae and egg stage, which is why fleas are so difficult to control. The eggs, larvae, and pupae are much harder to kill than adults. Treating your pet is not enough to end a flea infestation. Lawns and indoor carpets and rugs should be treated to kill flea eggs and larvae. There are several chemical and organic choices for lawn and carpet treatment.

Ticks are a major health concern for most companion animals, as well as for humans (Figure 31-12). Like fleas, both the pet and its environment must be treated to eliminate a tick infestation. Because ticks are a major carrier of Lyme disease and Rocky Mountain spotted fever, two serious diseases that affect humans, it is important to eliminate a tick infestation immediately. Dogs and cats that exercise outdoors are susceptible to ticks that have been transmitted from other pets and wild animals such as deer.

Breeding Companion Animals

Many owners of companion animals choose to breed their pets and sell the offspring. However, breeding animals can be time-consuming and expensive. Dogs are the most common pet bred for profit. In order to make the most profit from breeding, an animal should be registered to a specific breed and have a pedigree certificate to present to potential buyers. There are specific physiological standards that must be maintained before an animal can be registered. A **pedigree** is a dog's family tree. It lists the registered names of a dog's parents, grandparents, and great-grandparents, up to four or five previous generations. Pedigrees will also include any awards or titles won by a dog's ancestors. Pedigrees are useful tools when planning a breeding program to determine the breed qualities of the dog and the dog

pedigree

documentation that lists the registered names of an animal's parents, grandparents, and great-grandparents, up to four or five previous generations; it will also include any awards or titles won by an animal's ancestors

with which it is being bred. Most breeding programs aim to improve the breed standards. Puppies that are born to two registered parents with exceptional pedigrees will often garner a high price. Cats, birds, and other companion animals are also selectively bred to sell.

An affordable way to acquire a pet is from a shelter or animal rescue group. Most cats, dogs, and other companion animals have had their health checked by a veterinarian and have been spayed or neutered before being put up for adoption by these organizations. Shelters and other groups usually charge a nominal fee for adoption. Mixed breeds, as well as purebred animals, are available at shelters. If a particular breed is not available at the local shelter, check with breed rescue groups.

A recently popular option is a designer breed. Often, two breeds are combined to produce an animal with the desirable traits of each parent. For example, a cross between a Poodle and a Golden Retriever produces a dog called a Goldendoodle. It inherits a non-shedding hair coat from the Poodle and the laid-back personality of the Golden Retriever.

Pet Identification

Both dogs and cats need some type of identification on the animal. Proper identification allows the pet to be readily identified if it becomes lost, and allows the finder to return it to its home. An animal control center may be able to identify a pet by its identification number. If registered, the animal control center can find the owner's name, address, and telephone number.

Three common identification methods are the license tag, tattoo, and microchip. License tags are attached to a pet's collar (Figure 31-13). An animal's identification number will be listed on this tag if registered in a database. The tag should include a telephone number and address. There are several



©Stockphoto/Todd Taulman

FIGURE 31-13

Pets should have some means of identification, such as an identification tag on the collar.



©Stockphoto/Lena Andersson

FIGURE 31-14

An ear tattoo is a method of identification that can be used for the companion animal.

disadvantages to using license tags as identification, including the risk of a pet losing its collar, losing the license tag, or the information becoming worn and unreadable.

Identification tattoos are located on the inside of the ear (Figure 31-14). This type of identification is done after general anesthesia has been given, and is typically done during spay or neuter surgery. Tattoos are permanent but can fade over time. Identification tattoos often need to be retraced. Retracing is difficult to schedule because the pet must be given general anesthesia. Many veterinarians are hesitant to do this simply to retrace an identification tattoo because of the inherent risk that always accompanies general anesthesia.

The fastest growing and most popular method of pet identification is the microchip. This small electronic chip is implanted just beneath the animal's skin. Each microchip is associated with an identification number, which, along with the owner's name, address, and phone number, is entered into a computer database. Animal shelters and control centers are able to scan the animal's body for the microchip and quickly locate the identification number. Microchips are popular because they cannot be lost or misplaced, and the identification number will not fade over time.

Animal Shelters

Most local governments establish animal control centers to regulate the animal population of the area, and enforce animal protection and regulation laws. In addition to animal control centers, there are many animal shelters that have been established by private individuals. These are independently owned and operated. Animal shelters take in unwanted, abused, neglected, or stray animals. These animals are vaccinated, cared for, adapted to human interaction, and eventually offered for adoption.

limited admission shelter

a shelter that will only accept animals that are deemed adoptable; these shelters are also known as no-kill shelters

euthanasia

the practice of inducing a humane death in an animal

open admission shelter

a shelter that will take almost all animals; however, due to space and housing restrictions, some animals may be euthanized

spay

removing the reproductive capability of a female animal

neuter

removing the reproductive capability of a male animal

feral

wild, not domesticated

There are two types of animal shelters: limited admission and open admission. A **limited admission shelter**, also known as a no-kill shelter, will not euthanize animals. **Euthanasia** is the practice of inducing a humane death in an animal. Animals are kept at limited admission shelters until they are adopted. For this reason, limited admission shelters cannot accept and care for all animals. Limited admission shelters will only accept animals that are deemed adoptable. **Open admission shelters** take in almost all animals, but because of limited space and housing restrictions, animals that have not been adopted are eventually euthanized. There is no specific amount of time an animal shelter will hold an animal before euthanizing it. Instead, euthanizing an animal is based on the animal's adoptability, health care requirements, and other factors.

Pet owners can help reduce the number of animals that are taken to animal shelters. Pet owners should choose to **spay** or **neuter** their pets to avoid unwanted offspring. Spaying and neutering also reduces heightened aggression and territory marking. Spaying and neutering helps keep the total animal population down, specifically, the **feral** dog and cat populations. Feral dogs and cats will be picked up by local animal control centers. Feral animals are animals that were once domesticated, but now live in the wild. Because these animals are not adapted to humans and are not ideal for adoption, most feral dogs and cats taken to animal shelters are euthanized. Pets with suitable care and housing are less likely to run away and become a part of the feral pet population.

Laws Against Animal Cruelty

All states have laws against animal cruelty. Animal cruelty laws vary by state. Laws against animal cruelty do not give animals rights, but instead offer some legal protection against abuse and neglect.

The federal government passed the Animal Welfare Act in 1966. It has been amended several times. This act provides regulations for companion animal research facilities, animal shelters and control centers, the transportation of animals, stolen animals, and animal fighting. Farm animals used for food or fiber production are not regulated under the Animal Welfare Act. Most states have felony provisions for animal cruelty, although punishments vary from state to state. Most punishments include heavy fines and/or imprisonment, which range from a few months to several years.

There are also several groups and organizations that work to end animal cruelty. Many people confuse the terms “animal rights” and “animal welfare,” but there is a distinct difference. **Animal welfare** is the desire to end all cruelty and mistreatment of animals by establishing humane care standards for livestock production, companion animals, laboratory animals, and animals used for entertainment. **Animal rights** is the desire to end all human exploitation of animals. Some extreme animal rights groups want to end using animals for food production, zoos, guide dogs for the blind, and owning animals as pets. Some of these groups believe that animals have the same rights as humans.

animal welfare

the desire to end all cruelty and mistreatment of animals by establishing humane care standards for livestock production, companion animals, laboratory animals, and animals used for entertainment

animal rights

the desire to end all human exploitation of animals, including raising animals for food production, zoos, guide dogs for the blind, and owning animals as pets

Summary

A companion animal is any animal kept for enjoyment and companionship. A companion animal is not used for production. There are six main types of companion animals: dogs, cats, fish, small mammals, birds, and reptiles and amphibians. Dogs and cats are two of the most popular companion animals. Fish are also very popular and require specialized equipment for their maintenance and upkeep. Small mammals, such as gerbils, hamsters, and rabbits, require special facilities and cages with ample space, bedding, and exercise equipment. Birds come in a variety of species, and many species are very vocal and enjoy human interaction. Reptiles and amphibians are kept in enclosed terrariums that replicate their natural environment.

Each type of companion animal has different needs. Pet owners should research the health risks, dietary needs, and facilities required to properly care for their pets.

A common health concern for companion animals is external parasites, such as fleas and ticks. Both the pet and its environment must be treated to control a flea or tick infestation. Companion animals are identified either with a license tag, tattoo, or microchip. Animal shelters and control centers regulate and control the stray animal population. Animal shelters are owned, staffed, and operated by independent groups or individuals. Animal control centers are run by local governments. Companion animals that are not kept for breeding purposes should be spayed and neutered to help reduce the number of unwanted offspring animals. State and federal laws regulate the treatment of companion animals. Owning a pet can be beneficial, fun, and enjoyable, but all pet owners should be aware of the responsibility, costs, and time that companion animals require.

Quick Facts

- A companion animal is any animal kept as a household pet or in a close daily relationship with humans to provide enjoyment and companionship.
- There are six basic types of companion animals: dogs, cats, fish, small mammals, birds, and reptiles and amphibians.
- Although owning a pet is very popular, pet ownership requires a great deal of time and responsibility and may be expensive.
- Most of the more popular companion animals enjoy human interaction.
- Americans spend over \$40 billion per year on pet products and services.
- One of the most common health concerns for companion animals is external parasites, especially fleas and ticks.
- Breaking the flea life cycle is the key to eliminating a flea infestation.
- Three common companion animal identification choices are the license tag, tattoo, and microchip.
- There are two types of animal shelters: limited admission and open admission.
- A limited admission shelter, also known as a no-kill shelter, will not euthanize animals.
- Open admission shelters take in almost all animals. Animals that are not adopted are eventually euthanized.

- The Animal Welfare Act that was passed in 1966 provides regulations for research facilities, animal shelters and control centers, the transportation of animals, stolen animals, and animal fighting.
- State laws protect companion animals from animal cruelty.
- Animal rights is the desire to end all human exploitation and use of animals.
- Animal welfare is the desire to provide the humane care of animals, and to end all cruelty and mistreatment of animals.
- Some animal rights groups believe that animals have the same rights as humans.

Student Learning Activities

1. Volunteer at a local animal shelter. Interview workers at the animal shelter and actively participate in the daily activities required to maintain the shelter.
2. Prepare a record book with information about the cost and time required for keeping a pet.
3. Determine a task that you would like to train your companion animal to perform. Teach your companion animal this task and write down the steps necessary to properly train the animal.
4. Research the different types of available companion animals. Analyze which pet would best fit your lifestyle.
5. Research and prepare a report on current events concerning animal rights and animal welfare.

Discussion Questions

1. Explain the difference between a companion animal and a production animal.
2. Define the different dietary preference categories of reptiles and amphibians.
3. Describe the life cycle of the flea.
4. Explain the difference between limited admission and open admission animal shelters.
5. Make the distinction between animal rights and animal welfare.

Review Questions

True/False

1. All animals are capable of being completely domesticated.
2. Saltwater fish tanks are easier to maintain than freshwater fish tanks.
3. Americans spend more money on pet food than baby food.
4. Some reptiles are illegal to keep as pets in some areas.
5. The least popular method of pet identification is the microchip.

Multiple Choice

1. Which of the following animals is capable of being completely domesticated?
 - a. Tiger
 - b. Chimpanzee
 - c. Dog
 - d. Hedgehog
2. The _____ is considered the most intelligent of household birds.
 - a. Lovebird
 - b. Parrot
 - c. Canary
 - d. Cockatiel
3. The Animal Welfare Act was originally passed in _____.
 - a. 1966
 - b. 1975
 - c. 1996
 - d. 1956
4. Which of the following is NOT a common type of pet identification?
 - a. License Tag
 - b. Tattoo
 - c. Ear notch
 - d. Microchip

5. The most common companion animal that is bred for sale is the _____.
- a. Cat
 - b. Parrot
 - c. Python
 - d. Dog

Short Answer

- 1. Why are companion animals more popular among wealthier nations?
- 2. What is the importance of a water filter and an air pump in a fish tank?
- 3. List three foods that are toxic to birds.
- 4. Describe the different pet identification methods.
- 5. What bacteria are found naturally on reptiles and amphibians that may be passed to humans?



CHAPTER 32

Dogs



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe the seven major classification groups of dogs.
- Explain basic dog anatomy and physiology.
- Outline a program for basic dog care.
- Explain basic canine law.



KEY TERMS

puppy	estrus	toy group
bitch	whelp	non-sporting group
stud	pure breed	herding group
litter	mixed breed	miscellaneous group
dewclaw	designer breed	puppy mill
protein	sporting group	dog fighting
carbohydrate	hound group	
heartworm	working group	
monoestrus	terrier group	

LANGUAGE CONNECTION

English	French	German	Latin	Spanish
Dog	Chien	Hund	Canis	El Perro
Puppy	Chiot	Hündchen	Canellus	El Cachorro
Wolf	Loup	Wolf	Lupus	El Lobo
Flea	Puce	Floh	Pulex	La Pulga

Evolution of Dogs

The dog was one of the first animals to be domesticated for companionship, hunting, and protection. Dogs are believed to have originated between 12,000 to 14,000 years ago, and were domesticated approximately 10,000 years ago. While the majority of domesticated dogs are thought to have descended from the gray wolf, all canine-like species share a common ancestor, *Tomarctus* (Figure 32-1). The majority of dogs share a common paw structure, frame, and build that resemble those of the gray wolf.

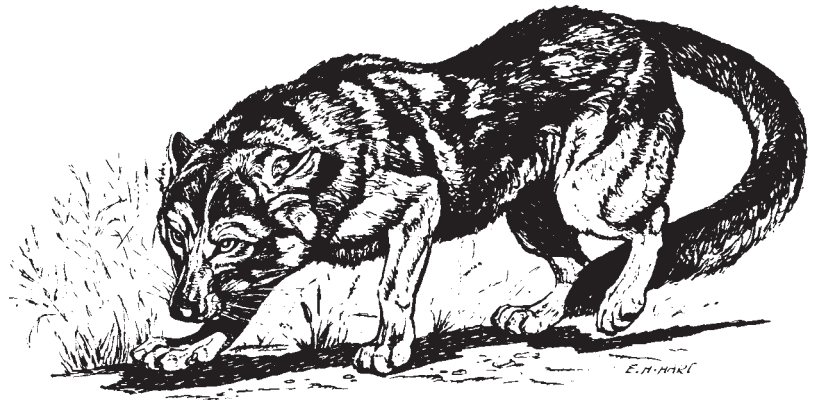
did you know?

Tomarctus, an extinct genus of canine, is believed to have lived approximately 7 million years ago. *Tomarctus*' progeny developed into all the canine-like species that we know today, including dogs, wolves, foxes, coyotes, and jackals. *Tomarctus* had a long fluffy tail and a bushy coat that was very similar to the dogs of today. Understanding evolutionary aspects of canines is important. It helps us determine how one species evolved from its ancestors, and how different breeds have evolved.

Today, dogs vary widely in size, hair coat, and shape. Dogs range in weight from as little as two pounds to more than 200 pounds. Dogs age seven

FIGURE 32-1

Tomarctus is considered the ancestor of all canine-type mammals.



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puppy

a young dog

bitch

a female dog

stud

a male dog

litter

a group of young animals born to one female at a single birth

times faster than humans. This means that every year of a dog's life is equal to seven years of a human's life. Dogs can live from 9 to 15 years or more, depending on their size, health, and the nutrition that they're given. **Puppies** are born to a **bitch**, or a female, and the father of the puppies is a **stud**, or a male dog. Females have puppies in groups called **litters**, and litters can include one to ten puppies on average.

Canine Anatomy and Physiology

Like people, dogs have anatomical features that make them special. Dogs have four toes on each paw, digital pads on each toe, and a metacarpal pad in the middle of each paw. These pads provide protection for the dog's bones while walking and running, and provide a way to reduce friction between the paws and surfaces such as floors or the ground. The pads on the feet also help to cushion the jolt of landing when jumping. Dogs are also characterized by the presence of a **dewclaw**, which is a rudimentary inner toe that does not reach the ground. Dewclaws are sometimes removed when the dog is young. Dogs are best-known for their noses and sense of smell. A dog's sense of smell is said to be a thousand times more sensitive than that of a human nose. A dog has over 200 million scent receptors in its nose, compared to the mere 5 million in humans.

dewclaw

rudimentary or primitive first digit (a toe) in animals

did you know?

This Nose Knows! A dog's nose is its most powerful organ! The canine nose has millions of scent receptors, allowing some dogs like bloodhounds to be able to smell and identify human skin cells that were shed days before. Dogs can be trained to sniff out anything with a scent including bombs, foods, drugs, rats, molds, termites, bedbugs, and even some melanoma cancers.

Dogs often have anatomical problems. Some larger dogs are prone to skeletal problems. Some smaller dogs are characterized by short, scrunched muzzles. These short-muzzled canines can be prone to respiratory issues because of their short noses and scrunched faces. Dogs with long, floppy ears can be prone to bad ears, with ear infections or a condition where the inner ear eventually grows together, causing the dog to become deaf. Responsible breeders certify their dogs against certain health defects such as hip, eye, or ear problems. These breeders work hard to help correct anatomical or physiological health problems through genetics.

Canine Care

Dogs need to be provided with basic care. A dog's four basic needs include feeding, grooming, exercise, and shelter. Along with these needs, dogs require some veterinary care each year. Most people would also include human contact, attention, and love as basic needs of the family dog.

Feeding

Food needs to be provided daily, and fresh, clean water should be constantly available. The amount of food and the number of times to feed a dog per day depend on the dog's size and whether the desired goal is weight loss, weight gain, or weight maintenance. A responsible dog owner should be

protein

an organic compound found naturally in plants and animals that is essential for growth and repair of body tissue

carbohydrate

an organic compound found primarily in plants, such as corn, that is broken down to provide energy to body cells

concerned with the quality and quantity of his or her dog's diet. There are no set rules for feeding dogs, but some general guidelines exist to help dog owners select the best food for their dogs.

Dogs are classified as carnivores, which means they are meat eaters. Dogs thrive on high **protein**, high meat diets. However, they can also eat and digest grains, such as corn. Most low-cost, commercially available dog food is based on corn flavored with either chicken or beef. It is essential to read the packaging label to select the best dog food. Grains provide mostly **carbohydrates**. Dogs fed high grain-based diets that are low in meat have a tendency to become overweight, have itchy, flaky skin, and coarse, brittle hair coats. They may have low energy levels and a low resistance to diseases. A well-balanced diet with a meat base is more expensive than high corn-based diets but better meets the needs of the dog.

Dogs generally should be fed twice per day, and should be given an amount that they will eat in a short period of time. Food should not be left out for them so that they can consume as much as they want because they can gain weight. A fat dog is unhealthy. Just as with other animals, and their human counterparts, dogs that are overweight may have problems with diabetes, heart disease, joint problems, and other ailments. When fed outdoors, extra feed attracts rats and mice, and in turn, snakes. Other animals, such as raccoons and opossums, will learn to visit a dog bowl for a free meal as well. Insects, such as flies and roaches, may also become a problem if food is left outside.

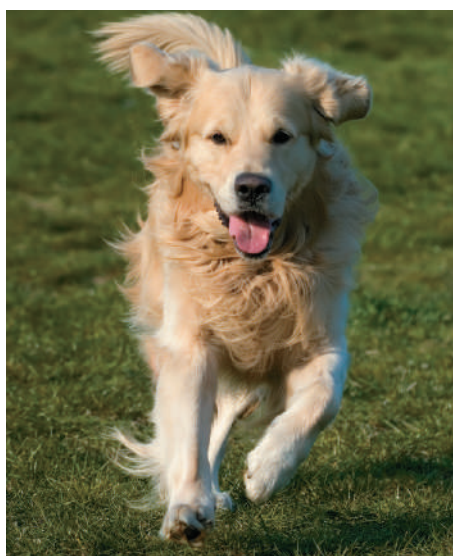
Solid, hard dog food provides a good diet for dogs, and the chewing of hard food helps to keep teeth and gums healthy while cutting down on plaque formation. While some consumers believe they are treating their pet better because they only feed their pet canned food, this can lead to dental disease, which in turn can lead to heart disease. A veterinarian can check for dental disease during a dog's yearly physical examination. Table scraps or human food should not be fed to dogs. This encourages negative begging behavior. Treats specialized for dogs are more



Delmar/Cengage Learning

FIGURE 32-2

Dogs require regular grooming.



©iStockWaiGon

FIGURE 32-3

All dogs should be allowed to exercise regularly.

acceptable, and should be given only as praise or as a reward and not in the place of regular food.

Grooming

A dog should be well-groomed and have a shiny coat and good skin (Figure 32-2). When grooming or bathing a dog, use a specialized shampoo for dogs. Human shampoo or soap can strip a dog's hair of natural oils, leaving the dog's coat dull and its skin dry and itchy.

The type of dog will dictate the amount of grooming needed on a daily, weekly, or monthly schedule. Some dogs with short hair, such as hounds, only require occasional bathing and brushing while the longer haired dogs, such as Yorkshire Terriers, require almost daily bathing or grooming. The hairless breeds of dogs, such as the Mexican Hairless dogs, require daily sunblock and moisturizing lotion.

Exercise

Dogs need exercise to stay healthy and prevent excessive weight gain. Dog owners should regularly exercise their dog by walking, running, playing fetch, etc. (Figure 32-3). Toy breeds usually require less exercise than terrier breeds, although all dogs should be allowed to run freely often to release extra energy.

did you know?

Flyball and agility competitions offer both dogs and owners a chance to get out and exercise. Both sport competitions offer owners a time where they can show off their training skills, and their lovable pets get the opportunity to run around while competing for “top dog” honors. In flyball, dogs run down a narrow strip and jump hurdles to retrieve a tennis ball from a station at the end of the “runway.” Flyball is often a team event, where a group of four or five dogs compete together to get the fastest team time. In an agility competition, however, dogs and handlers run through an obstacle course that requires the dogs to jump, weave in and out around poles, climb teeter-totters, and run across bridges. In both sports, the dog and handler with the fastest time wins!

Shelter

Dogs need some form of shelter, whether they live in the house or outside in the yard. The outside dog should be provided with a doghouse or other sound structure to keep it warm on cold or rainy days, as well as keeping it cool on hot days. Shavings or another form of bedding should be used inside the dog house to provide insulation from the cold.

Dog mats that are heated or electrical lamps can also be helpful in keeping a dog warm on cold days. These are especially helpful if the dog is older and needs to stay warmer. Electrical lamps should only be used indoors. Be aware of potential fire hazards, especially with heat lamps.

Dogs may rest for up to 20 hours a day. As dogs become older, they are subject to developing arthritis, and a soft, warm place to rest should be provided for them.

Training

Dogs generally want to please their masters and respond well to training. All dogs need some form of basic training so that their behavior will be acceptable in social situations. It is best to start training a dog when it is young. The basic training for any dog is house training, crate training, socialization, leash training, and the basic commands – “sit,” “stay,” and “come.”

House Training

House training is an essential part of training for dogs that are kept inside. There are many methods of house training a dog. Some people use “puppy pads” or training pads so that the puppy learns to go to the bathroom on the pad. Others try to encourage the dog to let its owner know when it needs to go outside. House training is often the most difficult, but by far, the most essential training when owning

a dog. Methods of house training vary, but all methods should include lots of treats and praise for good behavior.

Crate Training

Crate training can be used to aid in house training dogs, and the crate also provides a safe place for dogs to rest. Dogs are den animals, and will instinctively keep their rest area clean. They will normally wait to urinate and defecate until they are removed from the crate and allowed outside. Crate training can be an efficient and effective way to house train a dog.

Socialization

Socialization is probably the most overlooked component of training. Socialization is the introduction of the dog to new experiences. Dogs need to experience new places, people, animals, and things. Dogs need to be able to feel safe and realize that there is no threat in any new situations. This training should start early. Dogs that are not socialized can become fearful and bite or snap at strangers, owners, and other animals.

Leash Training

Leash training is essential to the dog and owner. The owner must be able to control the dog when taking the dog for walks and while traveling. A leash also provides the owner with a way to keep the dog safe, away from people who do not wish to have a dog around them, or away from other dogs.

Basic Commands

The most basic commands for dogs are “sit,” “stay,” and “come.” Once the basic commands have been learned, then the owner can move on to more complex commands like “down,” “shake,” and “roll over.” Teaching just the basic commands makes the dog more pleasurable to be around, for the owner as well as others.



Delmar/Cengage Learning

FIGURE 32-4

Dogs should have an annual veterinary examination.

Veterinary Care

Dogs require routine visits to the veterinarian. Annual physicals should be conducted to make sure that the dog is in good health. A veterinarian will check a dog's ears, eyes, heart, mouth and lungs, as well as test for heartworms and other disorders (Figure 32-4). Dogs will also get routine vaccinations which include distemper, parvovirus, rabies, and kennel cough. Some vaccines such as parvovirus, distemper, and canine influenza are available as combination vaccines.

Puppies should receive medical exams on a regular basis, starting at about 6 weeks of age. Puppies require a series of vaccinations to build up their immunity to diseases. Older dogs receive senior exams that often include bloodwork to check liver and kidney function, and routine X-rays to check for bone and joint problems.

Canine Health Plans

Dogs are vaccinated every year to prevent certain diseases. The most basic vaccines are for rabies, parvovirus, and kennel cough. Many groomers, pet sitters, and veterinarians will require a certificate or proof of vaccinations before they will take a dog into their care. Interaction of an infected dog with other dogs in their care may spread the disease. Regular treatments are also given to prevent common pests like fleas, ticks, and worms.

Rabies Rabies is the best-known canine disease. The rabies vaccination is required by law in most states. Rabies is a zoonotic, neurological virus that affects the brain and nervous system of the infected animal. Rabies includes such symptoms as excessive salivating, foaming at the mouth, becoming excessively irritable and aggressive, and disoriented in common situations.

According to the Center for Disease Control, dogs that bite a person and could be infected with rabies should be quarantined and observed for ten days. If a dog has been vaccinated for rabies and is bitten by a rabid animal, it is best to have the dog revaccinated and kept under supervision and observation for 45 days. Once symptoms appear, rabies is almost always fatal.

did you know?

Testing for Rabies – The only way for an animal to be tested for rabies is by euthanizing the animal and removing its head, including the brain stem. The head is then sent intact to a specialized laboratory where a section of the brain tissue is analyzed for the presence of the rabies virus. Laboratories often see specimens not only from dogs and cats, but from cows, sheep, and horses.

Parvo Parvo was discovered in 1967, and is an infection that is almost entirely exclusive to puppies. There is a 91% mortality rate in puppies infected by the parvovirus. A heavy infestation of worms can contribute to the formation of the disease. That is why it is so important for dogs to stay current with vaccinations and worming protocols. Parvo is carried by adult dogs and transmitted from dog to dog by fecal matter. It can be prevented by vaccination.

There are two types of parvo—a cardiac form and an intestinal form. The intestinal parvo works by destroying part of the intestinal tract so that the bacteria can then infect the rest of the body. Other symptoms include bloody diarrhea and vomiting that lead to excessive fluid loss, dehydration, and eventually death if not counteracted properly. The cardiac form causes respiratory or cardiovascular failure in young puppies.

Parvovirus can live in the ground for years. The virus is extremely hardy and most disinfectants will not kill it. The resiliency of the virus makes infection common, particularly in an area where there has been a previous outbreak.

Distemper Canine distemper is a viral disease that is fatal in approximately half of all cases. Distemper can be transmitted through respiratory secretions, fecal material, and urine of infected dogs. Puppies between 3 and 6 months of age are most susceptible, and most likely to die from distemper. In older dogs, the virus is usually combatted through the immune system and they may show few or no signs of infection. Distemper may cause rabies-like symptoms with aggressive behavior. Raccoons may carry canine distemper as well as other diseases that affect dogs. Canine and feline distemper are two different diseases with different symptoms, caused by two different viral agents. Feline distemper does not affect dogs.

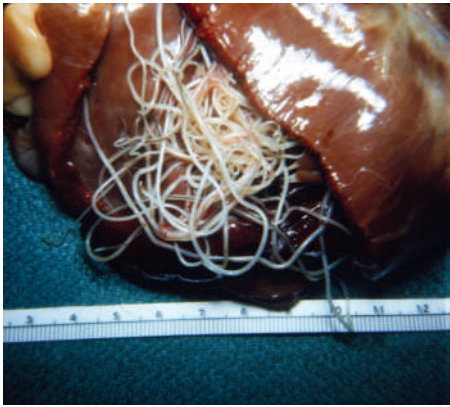
Kennel Cough Kennel cough is quite common in dogs that are kept in close contact with other unvaccinated animals. Kennel cough causes discomfort, but is not life threatening. Dogs that are affected with the disease will have a dry, hacking cough when the dog is active.

External Parasites Fleas and ticks are common pests to both dogs and owners. Fleas and ticks are particularly troublesome during the warmer months of the year. Fleas and ticks may be controlled with topical or oral treatments. Additional measures usually have to be taken to prevent fleas and ticks by treating the yard, house, or any other place frequented by the pet.

Internal Parasites Worms are a common health problem that is easily detectable and treatable in dogs. Worm species can be detected by looking at a fecal sample under a microscope. Roundworms, hookworms, tapeworms, and whipworms are treated with oral medications. Dogs can acquire worms from exposure to contaminated fecal matter of other dogs.

heartworm

a parasitic worm that lives in the heart of the dog; the dog is infested by the bite or ingestion of a mosquito



Delmar/Cengage Learning

FIGURE 32-5

Heartworms in a dog's heart.

monoestrus

an animal that has one or two estrus cycles per year

estrus

the time during which the female will accept the male for mating

whelp

term used to describe a female dog giving birth

Roundworms, hookworms, tapeworms, and whipworms infect most dogs at one time or another. Treatment for internal worms is inexpensive and manageable.

Heartworms are transmitted by mosquitoes. Dogs become infected through a mosquito bite or by ingesting a mosquito. Adult heartworms in the heart and the large blood vessels around it can cause extensive damage to some of the dog's vital organs (Figure 32-5). The lungs are the first organs affected. Just a few worms can cause considerable damage. As the disease develops, the heart becomes enlarged and does not function properly. Dogs in advanced stages of heartworm disease often cough frequently. Heartworms are preventable with monthly medication. If a dog gets heartworms, treatment can be very expensive and hard on the dog's health. Without prevention or treatment, heartworms are fatal.

Roundworm infections are common in the digestive tract of dogs. Dormant roundworm larvae in the mother dog's body may become active during pregnancy, resulting in 95–100% of puppies that are born infected with worms. Hookworms are blood-suckers. Three hundred adult hookworms can drain about 10% of the pet's blood in one day, often resulting in anemia.

Canine Reproduction

Dogs are **monoestrus** animals, meaning they usually display between one and sometimes two **estrus** cycles per year. Estrus cycles for female dogs usually begin at 6–12 months of age. However, larger breeds of dogs may not have their first estrus until 12–24 months of age. Estrus is the mating period of female animals. During reproduction, the male “locks” into the female. This gives the male sperm a better chance of reaching a viable egg. The females have a gestation length of 63 days and then the female will give birth, or **whelp**. Puppies' eyes are closed at birth. Their eyes open between seven and fourteen days of age,

although the time varies by breed. Puppies are usually weaned or removed from their mothers at 6 to 7 weeks of age. This helps them further develop their senses and independence.

did you know?

A litter of puppies can have numerous fathers. This means each puppy in the litter can conceivably have a different father (Figure 32-6). Dogs release multiple eggs and each egg can be fertilized by a sperm from a different male if the mother breeds with multiple males.



FIGURE 32-6

A mixed litter of puppies.

Spaying and Neutering

It is important that dogs that are not used for breeding purposes are spayed (female) or neutered (male). Spaying and neutering removes part or all of the sexual reproductive organs of the animal. Having pets spayed or neutered helps avoid unwanted puppies. Pets that are not spayed or neutered should be kept inside unless under direct supervision of the owners. Females that are allowed to wander and are not spayed have an almost 100% possibility of having an unplanned litter of puppies.

Many unexpected puppies end up in animal shelters where millions of unadopted puppies must be euthanized each year.

Spayed or neutered pets make excellent companions. Since the sexual instincts of the animal become inhibited, spayed or neutered pets generally display a milder temperament than their counterparts.

Pure Breeds and Mixed Breeds

pure breed

a group of animals similar in appearance, characteristics, and disposition

mixed breed

a dog that is a mix of two or more different breeds

designer breed

a breed created by the planned crossing of two purebred dogs

A **pure breed** is a group of animals similar in appearance, characteristics, and disposition. Each breed has a set of standards by which the breed is judged and maintained. The breed standards describe how a specific breed should ideally look and act.

A **mixed breed** is a dog breed that is a mix of two or more different breeds (Figure 32-7). Some mixed breeds are known as designer breeds. **Designer breeds**, or a planned cross of two or more purebred breeds, have become increasingly popular and include the Goldendoodle (a cross between a Golden Retriever and a Poodle) and Labradoodle (a cross between a Labrador Retriever and a Poodle). The intent of these designer dogs is to combine the best characteristics of the parent breeds. For example, Goldendoodles are considered to be hypoallergenic because of their tendency to not shed. This desirable trait is inherited from the poodle. The Goldendoodle may inherit the Golden Retriever's very calm and sedate personality.

Purebred dogs have registries and are recognized by the American Kennel Club and other similar groups. Purebred dogs are not necessarily better than a mixed-breed dog, and vice versa.



Courtesy of Amanda Stephens

FIGURE 32-7

A mixed-breed dog will exhibit characteristics and features of two or more breeds.

Where to Find a Dog

While many people looking for a particular breed turn to respectable breeders, some people opt to adopt animals from animal control shelters, humane societies, and breed rescue organizations. Animal

control shelters are often operated by the county or city government. These organizations pick up stray animals from the street and take in animals that owners surrender. Animal control also deals with hoarding (when a person tries unsuccessfully to take care of too many animals), puppy mills, and abuse cases, such as dog fighting.

Privately-owned animal shelters also take in animals that have been surrendered by their owners, and will sometimes pick up dogs from animal control shelters that are in danger of being euthanized. No-kill shelters, or limited admission shelters, are a special kind of shelter that only takes in animals that are deemed adoptable.

Breed rescue organizations take in purebred or mixed breed animals. Many of these organizations are listed on the American Kennel Club's website. Local shelters and government animal control organizations may also have purebred animals available for adoption.

Classifying Dogs

Seven major groups are recognized by the American Kennel Club (AKC). They are the sporting group, the hound group, the working group, the terrier group, the toy group, the herding group, and the non-sporting group. In addition to the seven main groups, the AKC has established a miscellaneous group. All of the dogs in each of the individual groups share a central purpose or goal that is often derived from past usage of the breeds, or has been set forth as certain standard requirements and skills for individual breeds.

The Sporting Group

The **sporting group** is a group of dogs that was developed to assist hunters in the pursuit of game, both in the water and the woods. Members of this group include the pointers, retrievers, setters, and spaniels. These dogs are known for their loyalty,

sporting group

the AKC-recognized group of dogs that was developed to assist hunters in the pursuit of game

TABLE 32-1

Breeds in the Sporting Group

American Water Spaniel	Golden Retriever
Boykin Spaniel	Gordon Setter
Brittany	Irish Red and White Setter
Chesapeake Bay Retriever	Irish Setter
Clumber Spaniel	Irish Water Spaniel
Cocker Spaniel	Labrador Retriever
Curly-Coated Retriever	Nova Scotia Duck Trolling Retriever
English Cocker Spaniel	Pointer
English Setter	Spinone Italiano
English Springer Spaniel	Sussex Spaniel
Field Spaniel	Vizsla
Flat-Coated Retriever	Weimaraner
German Shorthaired Pointer	Welsh Springer Spaniel
German Wirehaired Pointer	Wirehaired Pointing Griffon

trustworthiness, and undying willingness to please their owners. There are twenty-six individual breeds within the sporting group (Table 32-1). These dogs are most often medium to large in size and, like all dogs, have a very keen sense of smell. A prime example of the sporting group is the Golden Retriever (Figure 32-8). This breed is also popular among dog owners in general.

The Hound Group

Like the sporting group, the dogs in the **hound group** were bred to hunt. Twenty-three breeds make up the hound group (Table 32-2). There are two sub-classifications of hounds: scent hounds and sight hounds. Sight hounds primarily hunt by sight and speed, and include the Whippet and Borzoi. Dogs that are primarily scent hounds have smaller, shorter bodies that keep them low to the ground to

hound group

the AKC-recognized group of dogs that was developed to hunt

FIGURE 32-8

The Golden Retriever is a member of the sporting group.



Courtesy of Whitney Kizer

better capture a scent. The long, droopy ears of most hound breeds help to capture a scent and keep it close to the nose so the hound can stay hot on the trail. The Beagle is a prime example of the hound group (Figure 32-9). Most dogs in the hound group are known for their distinct ability to produce a unique sound known as baying.

TABLE 32-2

Breeds in the Hound Group

Afghan Hound	Ibizan Hound
American Foxhound	Irish Wolfhound
Basenji	Norwegian Elkhound
Basset Hound	Otterhound
Beagle	Petit Basse Griffon Vendeen
Black and Tan Coonhound	Pharoah Hound
Bloodhound	Plott
Bluetick Coonhound	Redbone Coonhound
Borzoi	Rhodesian Ridgeback
Dachshund	Saluki
English Foxhound	Scottish Deerhound
Greyhound	Whippet
Harrier	



Photo by Isabelle Francais

FIGURE 32-9

The Beagle is a member of the hound group.



Legal Connection

The Bloodhound is so adept at scent-tracking that its trailing results are admissible evidence in a court of law. Its outstanding ability to read terrain with its nose is due to a large, ultra-sensitive set of scent membranes that allows the dog to distinguish smells at least a thousand times better than humans.

working group

the AKC-recognized group of dogs that was developed to labor or work for humans

The Working Group

Dogs in the **working group** were developed to work for humans. Many of these breeds are commonly used as guard dogs, police dogs, and rescue or sled dogs. The twenty-six individual breeds that make up the working group have a strong muscular build and sturdy bone structure, and are sometimes intimidating in appearance (Table 32-3). Much of a

TABLE 32-3

Breeds in the Working Group

Akita	Greater Swiss Mountain Dog
Alaskan Malamute	Komondor
Anatolian Shepherd Dog	Kuvasz
Bernese Mountain Dog	Leonberger
Black Russian Terrier	Mastiff
Boxer	Neapolitan Mastiff
Bullmastiff	Newfoundland
Cane Corso	Portuguese Water Dog
Doberman Pinscher	Rottweiler
Dogue de Bordeaux	Saint Bernard
German Pinscher	Samoyed
Giant Schnauzer	Siberian Husky
Great Dane	Standard Schnauzer
Great Pyrenees	Tibetan Mastiff



Photo by Isabelle Francais

FIGURE 32-10

The Rottweiler is a member of the working group.

terrier group

the AKC-recognized group of dogs that was developed to hunt and kill small animals and vermin

dog's temperament is dependent upon its relationship with humans and other animals and its training (Figure 32-10).

The Terrier Group

Terriers, members of the **terrier group**, are feisty, energetic animals that vary in size from 8 inches to over 23 inches in height. Terriers were originally bred to hunt small animals and vermin. Breed clubs still hold competitions to test a terrier's hunting skills. There are twenty-seven individual terrier breeds (Table 32-4). The breeds of the terrier group are known to have a dominance/alpha complex that causes these dogs to have little tolerance for other animals, including other dogs. The Airedale Terrier is a member of the terrier group (Figure 32-11).

TABLE 32-4

Breeds in the Terrier Group

Airedale Terrier	Miniature Schnauzer
American Staffordshire Terrier	Norfolk Terrier
Australian Terrier	Norwich Terrier
Bedlington Terrier	Parson Russell Terrier
Border Terrier	Scottish Terrier
Bull Terrier	Sealyham Terrier
Cairn Terrier	Skye Terrier
Dandie Dinmont Terrier	Smooth Fox Terrier
Glen of Imaal Terrier	Soft-Coated Wheaten Terrier
Irish Terrier	Staffordshire Bull Terrier
Kerry Blue Terrier	Welsh Terrier
Lakeland Terrier	West Highland White Terrier
Manchester Terrier	Wire Fox Terrier
Miniature Bull Terrier	



Photo by Isabelle Francais

FIGURE 32-11

The Airedale Terrier is a breed in the terrier group.

did you know?

The original breed called the Russell Terrier was developed by a preacher in Australia – Parson Jack Russell. The breed has split into two separate breeds: the Jack Russell and the Parson Russell Terriers. The Parson Russell Terriers are a recognized breed of the American Kennel Club (AKC) and consist of the dogs with long legs. The Jack Russell Terriers are the short legged version of the Parson Russell Terriers and are recognized by the Continental Kennel Club (CKC).

toy group

the AKC-recognized group of dogs that was developed for small size

The Toy Group

Breeds associated with the **toy group** are known for their small stature and their expressive nature. These twenty-six little breeds are extremely popular with those that live in apartments or small houses (Table 32-5). The pug is an example of a toy breed (Figure 32-12).

TABLE 32-5

Breeds in the Toy Group

Affenpinscher	Miniature Pinscher
Brussels Griffon	Papillon
Cavalier King Charles Spaniel	Pekingese
Chihuahua	Pomeranian
Chinese Crested	Poodle
English Toy Spaniel	Pug
Havanese	Shih Tzu
Italian Greyhound	Silky Terrier
Japanese Chin	Toy Fox Terrier
Maltese	Yorkshire Terrier
Manchester Terrier	



Photo by Isabelle Francais

FIGURE 32-12

The Pug is a breed in the toy group.

non-sporting group
the AKC-recognized group of dogs that was developed to be companion animals

The Non-Sporting Group

Dogs in the **non-sporting group** were bred to be companions to their owners. The seventeen breeds of the non-sporting group vary greatly in size, coat, personality, and appearance (Table 32-6). They generally have a very feisty personality and show immense loyalty to their owners. This group includes the Dalmatian, the English Bulldog (Figure 32-13), and the Lhasa Apso.



Photo by Isabelle Francals

FIGURE 32-13
The English Bulldog is a breed in the non-sporting group.

herding group
the AKC-recognized group of dogs that was developed to move people or animals in groups

TABLE 32-6

Breeds in the Non-Sporting Group (selected)

American Eskimo Dog	French Bulldog
Bichon Frise	Keeshond
Boston Terrier	Lhasa Apso
Bulldog	L��wchen
Chinese Shar-Pei	Poodle
Tibetan Spaniel	Schipperke
Chow Chow	Shiba Inu
Dalmatian	Tibetan Terrier
Finnish Spitz	

The Herding Group

The **herding group** is the newest classification recognized by the American Kennel Club. There are twenty-two breeds included in the herding group (Table 32-7). These dogs share a common instinctive ability to herd or move other animals and people. Some of these dogs, such as the German Shepherd or the Belgian Malinois, are trained as police dogs. Other dogs in this group are more commonly used as herders and assist farmers and ranchers. This group includes the Border Collie, Australian Cattle Dog, and the Pembroke Welsh Corgi (Figure 32-14).



Photo by Isabelle Francais

FIGURE 32-14

The Pembroke Welsh Corgi is a breed in the herding group.

miscellaneous group

the breeds that have yet to be fully recognized by the American Kennel Club

TABLE 32-7

Breeds in the Herding Group (selected)

Australian Cattle Dog	Briard
Australian Shepherd	Cardigan Welsh Corgi
Bearded Collie	Collie
Beauceron	German Shepherd
Canaan Dog	Old English Sheepdog
Polish Lowland	Norwegian Buhund
Belgian Malinois	Pembroke Welsh Corgi
Belgian Sheepdog	Puli
Belgian Tervuren	Pyrenean Shepherd
Border Collie	Shetland Sheepdog
Bouvier des Flandres	Swedish Vallhund

The Miscellaneous Group

There are currently eleven dog breeds classified under the **miscellaneous group** (Table 32-8). Dogs of the miscellaneous group are those breeds that have yet to be fully recognized by the American Kennel Club. This class is not displayed in dog shows, but they are very common. This group is ever-changing as some breeds grow and are admitted to the American Kennel Club.

TABLE 32-8

Breeds in the Miscellaneous Group (selected)

American English Coonhound	Rat Terrier
Cesky Terrier	Russell Terrier
Chinook	Treeing Walker Coonhound

Specialized Canines

Some dogs are trained for specialized jobs. Some are trained to work as seeing-eye dogs or assistance dogs. These dogs help assist those who are blind or

have special needs so that they can live more normal, satisfying, and independent lifestyles. Other specialized canines include those trained to do police or security work. These dogs help law enforcement agencies make arrests, find missing persons, and protect the general public. Some examples are canine officers, drug detection dogs, security dogs, customs dogs, search and rescue dogs, cadaver dogs, or bomb detecting dogs.

did you know?

Hero Dog of the Year – National Dog Day is conducted each year to celebrate dogs and their owners. This day also recognizes canine heroes that go above and beyond the call of duty when it comes to loyalty to their owners. Some would call these dogs “modern day Lassies” coming to the rescue and saving the day.

Canine Law

There are rules and laws that apply to the treatment of dogs and other animals. Many jurisdictions have leash laws that require a dog to be kept on a leash when it is out in public or being walked in a public area. Leash laws help provide safety to other people and dogs. If a dog is on a leash, it is less likely to get away from the owner, bite someone, or run out into traffic.

Animal cruelty and neglect laws were established to provide some legal protection for animals. Dog owners who do not provide proper care, or who abuse or neglect their dog, are exhibiting animal cruelty. If a person is found guilty of animal cruelty or neglect, they face having their animal taken from them, heavy fines, and/or imprisonment.

puppy mill

a commercial dog breeding operation that operates under substandard conditions

dog fighting

an illegal activity in which dogs are trained to fight other dogs

Puppy mills are commercial dog breeding operations that operate in substandard conditions. These puppies have a higher tendency to develop disease and have a greater likelihood of having more physical and behavioral problems.

Dog fighting is an illegal sport in which dogs are trained to be vicious and fight other dogs. Bets are placed, and then the dogs are put into a ring to fight each other, often to the death. Dogs that cannot or will not continue to fight are often killed. People found guilty of involvement in a dog fighting operation may be punished with fines and prison terms.

Summary

Dogs have been bred for thousands of years to be companions to humans. Our canine companions have become part of our families, and need care and comfort. By providing the proper environment and care, it is possible to raise a happy, healthy, and well-behaved dog. It is important to understand the history and breeding of a dog in order to select one for the desired purpose. Giving a dog proper veterinary and routine care will help it to live a long and healthy life. It is important to select the correct dog food and to feed in appropriate portions. With an understanding of what is required for a dog's basic care and needs, owning a dog can be a very rewarding experience.

Quick Facts

- The dog was one of the first animals to be domesticated for companionship, hunting, and protection.
- The American Kennel Club recognizes seven dog groups: the sporting group, the hound group, the working group, the terrier group, the toy group, the herding group, and the non-sporting group. The AKC also recognizes a miscellaneous group.
- A mixed breed is a dog that is a mix of two or more breeds, or has parents of unknown origin.

- Purebreds have registries and are recognized by such groups as the American Kennel Club.
- Some dogs have specialized jobs as seeing-eye dogs, canine officers, drug detection dogs, security dogs, customs agent dogs, search and rescue dogs, or bomb detecting dogs.
- A dog's sense of smell is about 1000 times greater than that of a human.
- Dogs are monoestrus animals, meaning they usually display one and sometimes two estrus cycles per year.
- A dog's four basic needs include feeding, grooming, exercise, and shelter.
- Dogs require routine visits to the veterinarian.
- Some common health concerns for dogs are rabies, canine parvovirus, canine distemper, heartworms, and internal parasites.
- Leash laws help provide safety to other people and dogs.
- Animal cruelty and neglect laws have been established to provide some legal protection for animals.

Student Learning Activities

1. Visit a small animal veterinary office.
2. Have students choose a breed of dog to research and give a report to the class.
3. Visit an animal shelter.
4. Research different animal rights activist groups.
5. Have a knowledgeable person talk to the class about responsible pet ownership.

Discussion Questions

1. Compare and contrast the different dog groups that have been established by the American Kennel Club.
2. Why should dog food not be provided at all times so the dog can eat all it wants?
3. Describe the four basic needs of a dog.
4. What are three common health concerns for dogs?
5. What are some illegal practices with regards to canine animal cruelty?

Review Questions

True/False

1. Modern domesticated dogs are primarily descendants of the brown wolf.
2. A purebred dog is better than a mixed breed dog.
3. The two types of hounds are scent hounds and sight hounds.
4. Some mixed breed dogs are called designer dogs.
5. Routine vaccinations for dogs include Distemper, Parvo, Rabies, and Kennel Cough.

Multiple Choice

1. *Tomarctus* is believed to have lived _____ million years ago.
 - a. six
 - b. five
 - c. seven
 - d. nine
2. Which of the following is not a major dog group?
 - a. The Hunting Group
 - b. The Herding Group
 - c. The Sporting Group
 - d. The Terrier Group
3. The dog's _____ is its most powerful organ.
 - a. ear
 - b. eye
 - c. heart
 - d. nose
4. If a dog has received its rabies vaccination but is bitten by a rabid animal, the dog's owner should:
 - a. do nothing
 - b. have the dog revaccinated and keep it under observation for 45 days
 - c. have the dog euthanized
 - d. have the dog revaccinated only after it shows signs of a rabies infection

5. Which of the following is not a common type of internal parasite for dogs?
- a. Armyworm
 - b. Whipworm
 - c. Roundworm
 - d. Tapeworm

Completion

1. _____ are the most destructive of the worm species.
2. There are _____ major groups recognized by the American Kennel Club.
3. Heartworms can be spread by _____.
4. _____ and _____ removes part or all of the sexual reproductive organs of the animal.
5. Dogs generally have _____ estrus cycle(s) per year.

Short Answer

1. How did the American Kennel Club establish the seven major classification groups?
2. Dogs are classified as carnivores. What does this mean?
3. What are some ways a dog owner can exercise his or her dog?
4. List the symptoms experienced by a dog infected with rabies.
5. Describe two laws that apply to dogs.



CHAPTER 33

Cats



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe the domestication of cats.
- Outline basic cat behavior and instincts.
- Describe the basic care of cats.
- List diseases and health concerns associated with cats.



KEY TERMS

kitten
queen
tom or tomcat
feral cat

Jacobson's organ
declaw
meow
purr

righting reflex
fur ball
induced ovulator
parturition

LANGUAGE CONNECTION

English	French	German	Latin	Spanish
Cat	Chat	Katze	Feles	El Gato
Feral (wild)	Sauvage	Ungezähmt	Ferus	Salvaje
Kitten	Chaton	Kätzchen		El Gabilto
Neutered	Castré	Kastriert	Semivir	Castrado

Scientific Classification of Cats

Kingdom	–	Animalia
Phylum	–	Chordata
Class	–	Mammalia
Order	–	Carnivora
Family	–	Felidae
Genus	–	Felis
Species	–	<i>F. catus</i>

Evolution of Cats

Cats have been interacting with humans for at least 9,500 years and have been domesticated for at least 4,000 years. In ancient civilizations, cats were used in agriculture to reduce rodent and snake populations. When humans began harvesting and storing grains, rats and mice became a problem. In turn, these rats and mice began to attract snakes. To reduce the growing populations of pests, humans used cats, which were prized for their hunting and predatory skills. The domestic cat also has highly refined sensory systems, including heightened senses of smell and hearing, that make it a skilled predator.



History Connection

In ancient Egypt, cats initially gained value as predators of rodents that plagued farmers and homeowners. Although the cats were initially feral, they eventually became domesticated as they interacted with humans. As the cat's importance grew and its role became more valuable, the ancient Egyptians began to worship the cat not only for its usefulness, but also for its grace and poise. The cat also gained prominence as a figure in the Egyptian home. In fact, when a family's cat died, the family would go into a deep mourning and even shave their eyebrows as a sign of mourning for their lost pet. Cats were mummified in ancient Egypt. Not only were cats worshipped and treated as invaluable members of the family, but the penalty for killing a cat in ancient Egypt, whether intentionally or unintentionally, was death.



©Image Source

FIGURE 33-1

The cat is a common companion animal for humans.

kitten

young cat

queen

female cat

tom or tomcat

male cat

The domestic cat that humans use as a companion animal evolved from mammals in two genus groups: *Profelis* and *Felis*. The *Profelis* genus has only one species, the African Golden Cat. Cats in the genus *Profelis* are wild cats and are slightly larger in size than the domestic cat. The more common ancestors of the domestic cat belong to the genus *Felis*, which includes the Wildcat and Jungle Cat. Cats in the genus *Felis* are medium to small in size and have keen predatory instincts, making them some of the most skillful hunters. This same predatory instinct can be seen in domestic cats as well.

The typical domestic cat weighs between 6 and 15 pounds and has a lifespan of approximately 12 to 18 years (Figure 33-1). Cats have much less variation in their body size and weight than dogs. A newborn cat is called a **kitten**. Kittens are born in litters of 3 to 7 to a **queen** (female), and are sired by a **tom** or **tomcat** (male).

Classifying Cats

Cats are classified according to their genus type. The genus *Panthera* contains the big cats: the lion, leopard, tiger, and jaguar. These big cats are also the only species in the family *Felidae* who can roar. The genus *Felis* contains small- to medium-sized cats that cannot roar. The species in this genus have the unique ability to purr. The genus *Acinonyx* has only one subspecies, the cheetah.

Some domestic cats are purebred, but the majority of cats are not. In fact, over ninety percent of cats are not classified by breed. Purebred cats are classified according to hair type and are separated into two groups, shorthaired breeds and longhaired breeds. Shorthaired breeds have short, sleek coats and require less grooming than their longhaired counterparts. Examples of shorthaired breeds include the Siamese, Burmese, and the American Shorthair (Figure 33-2). Longhaired breeds have longer coats that require more brushing and grooming. Examples



Photo by Isabelle Francais

FIGURE 33-2

The American Shorthair is an example of a short-haired cat breed.



Photo by Isabelle Francois

FIGURE 33-3

The Maine Coon is an example of a long-haired cat breed.

of longhaired breeds include the Persian, Birman, and Maine Coon (Figure 33-3). Along with fur length, a breed of cat shares a unified appearance, similar characteristics and personalities, as well as fur coloring. These standards are maintained to ensure the purity of the breed. The Cat Fanciers' Association (CFA) is the world's largest registry of pedigreed cats. The CFA recognizes over 40 pedigreed breeds of cats (Table 33-1). Although not recognized by the Cat Fancier's Association, the most popular cats are the domestic shorthair and domestic longhair.

TABLE 33-1

Breeds of Cats

Abyssinian	Laperm
American Bobtail	Maine Coon
American Curl	Manx
American Shorthair	Norwegian Forest Cat
American Wirehair	Ocicat
Balinese	Oriental
Birman	Persian
Bombay	Ragamuffin
British Shorthair	Ragdoll
Burmese	Russian Blue
Chartreux	Scottish Fold
Chinese Li Hau	Selkirk Rex
Colorpoint Shorthair	Siamese
Cornish Rex	Siberian
Devon Rex	Singapura
Egyptian Mau	Somali
European Burmese	Sphynx
Exotic	Tonkinese
Havana Brown	Turkish Angora
Japanese Bobtail	Turkish Van
Korat	

feral cat

wild cats, not domesticated; strays

Although most domestic cats are house pets, some domestic cats that have never had interaction with humans, or that do not have regular interaction with humans, become **feral cats**. Feral cats are wild cats that live outside and are commonly known as strays. Feral cats have no owner and will typically display aggressive behavior if approached by humans.

Feeding

Because cats are strictly carnivores, they need to consume large amounts of animal-based proteins. Plant-based proteins cannot be efficiently digested by a cat and will provide much less nutrition. Some cat foods contain large amounts of plant-based carbohydrates and proteins and not enough meat proteins. Feeding poor quality feeds can be an unhealthy option for cats, as this can make the cats overweight. Although canned cat food may be more expensive, high quality canned food generally contains more meat protein. Cats that are fed a high quality commercial food usually do not have to be fed additional vitamins and minerals. Clean, fresh water should be provided for cats at all times.

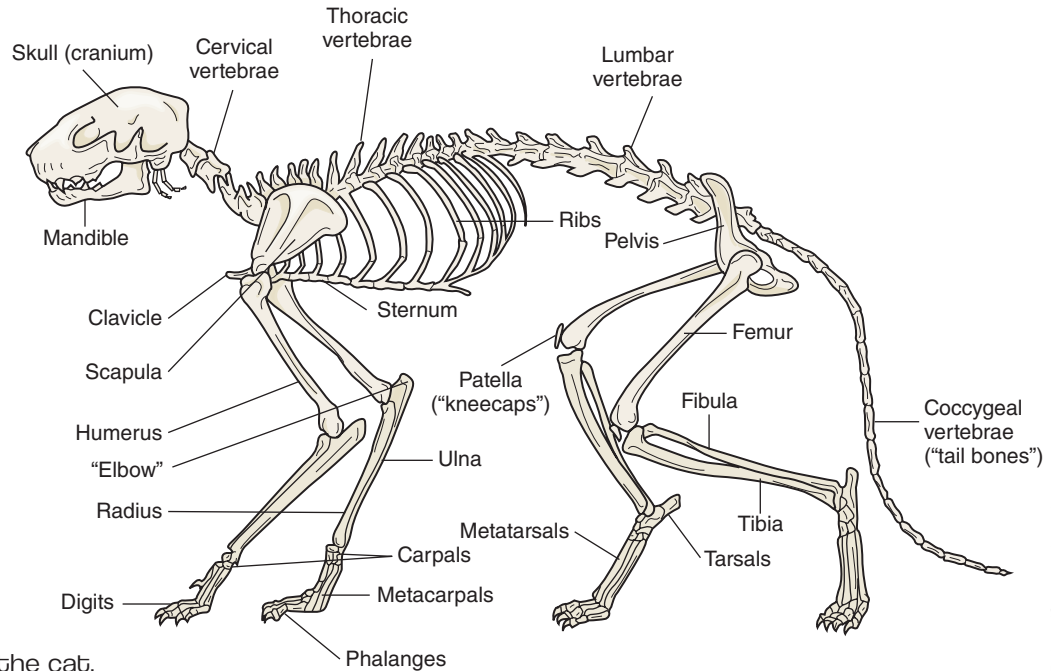


Economics Connection

In the United States, consumers spend about $\frac{1}{3}$ more money on cat food than on baby food. When the cost of food, veterinary bills, toys, etc., is tallied, it amounts to a large industry reaching billions of dollars each year and creating many career opportunities.

Feline Anatomy

The domestic cat has 244 bones and 500 separate muscles, both of which allow the cat to maintain high agility and ease of movement (Figure 33-4).



Delmar/Cengage Learning

FIGURE 33-4

Skeletal structure of the cat.



Biology Connection

About ten percent of a cat's bones are in its tail. The tail is used by the cat as a counterbalance to the body during quick movements. Cats that lose their tails often have balance problems, and may develop back problems.



Biology Connection

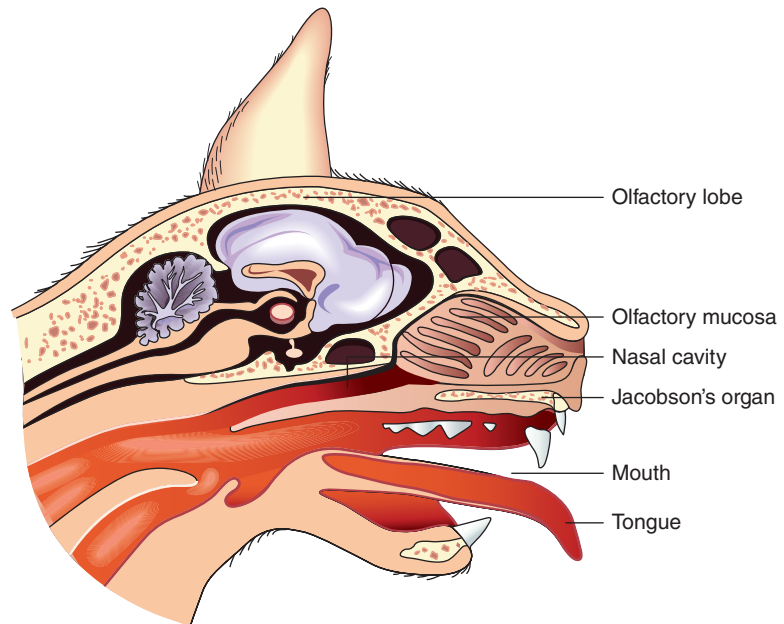
Cats have free-floating clavicle bones or collar bones. This allows the cat to pass its body through any space into which it can fit its head. Another animal with free-floating clavicle bones is the mouse. If a cat and a mouse can get their heads through an opening, then the remainder of their bodies will pass through as well.

Jacobson's organ

a scent organ located in a cat's upper mouth, behind the front teeth, that helps the cat to smell

Jacobson's Organ

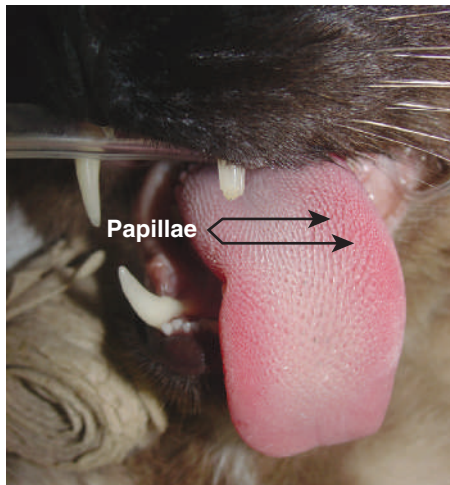
Cats also have some specialized parts of their anatomy. The **Jacobson's organ** is found inside the mouth, just behind the front teeth; this organ



Delmar/Cengage Learning

FIGURE 33-5

The Jacobson's organ is a structure that allows a heightened sense of smell in cats.



Courtesy of Teri Raffel, CVT

FIGURE 33-6

Papillae are the backward-facing spines on a cat's tongue. These hooked spines act as a sort of hair brush as the cat grooms itself.



Health Connection

When cats clean themselves, they deposit their saliva over their bodies. The saliva contains a protein that, when dry, becomes airborne. This airborne protein is the allergen to which many people are allergic. So it is cat saliva, not cat hair, which causes an allergic reaction in many people.

declaw

the removal of the cat's claws, often done to prevent damage done by scratching

meow

the vocalization a cat uses to communicate, usually with humans

purr

a sound that a cat makes for communication purposes, this sound may be soothing to the cat

Claws

Cats have retractable claws, meaning that a cat can push out or pull in its claws. Many pet owners choose to have their house cat **declawed**, which means the removal of the claws to prevent damage done by scratching. Usually it is only necessary to remove the front claws. When a cat goes in to be declawed, the cat is first sedated, the claws are cut out, and then either the skin is sewn or glued back together. If done improperly, the removal of the nails can be not only painful, but the area can become infected.

Why do cats scratch? Cats have specialized scent glands between their toe pads. These glands deposit the cat's scent when they scratch, which marks their territory visually and with their scent.

Feline Behavior

Most cats are described as low maintenance, independent, and self-serving animals. Cats are typically not as social as dogs and other companion animals, but most domestic cats still enjoy human interaction.

Normal Communication

Domestic cats display two types of normal communication: meowing and purring. The **meow** is usually used only with humans and rarely used in response to another cat. A cat will typically meow at a human when it wants something, whether to be fed, given attention, or to go outside. Another form of communication, and one that seems much more unusual, is the cat's **purr**. All domestic cats are born with the ability to purr. Both kittens and the queen will purr during nursing. Almost all cats will begin to purr when they are being petted or shown affectionate attention. Purring is often seen as a sign of happiness or contentment, but cats also purr during traumatic and even life-threatening situations. Purring can be a self-soothing mechanism for cats.



Biology Connection

The meow sound can only be made properly when it is started with the mouth closed and ended with the mouth closed. Humans have to follow this rule as well in order to make the meow sound. Try it.

did you know?

Meows are directed almost exclusively at humans and rarely toward other cats. This may be an extension of the similar 'mew' sound that kittens use to signal a request to their mothers. Cats communicate with other cats mainly by using body language and scent. Wild cats only produce a few sounds, while domesticated cats produce a wide variety for the sole purpose of communicating with humans. The pitch of the meow can help you understand its meaning. The lower the sound, the more agitated the cat is. If the meow sound is high-toned, the cat is probably quite happy to convey his or her message.



©iStockphoto/Jakub Wojtowicz

FIGURE 33-7

Arching of the back and hissing are defensive mechanisms a cat will exhibit when angry or frightened. The arched back and hair standing on end make the cat look bigger and more threatening to an opponent.

Defensive Communication

When faced with a tense or undesirable situation, a cat will display three types of defensive communication: hissing, growling, and arching its back (Figure 33-7). When a cat hisses, it will open its mouth, bare its teeth, and release air in a loud hiss. Cats use hissing when angered or in danger. Growling is often used for the same purpose. Cats will also hiss and growl at each other to establish boundaries or limits. If a kitten pounces on an older cat and the older cat hisses, the older cat is setting a boundary with the kitten that should not be crossed. Cats use the arched back behavior to make themselves appear larger and more

threatening when in danger. In addition to arching the back, cats will often flatten their ears and hiss to seem even more menacing.

Righting Reflex

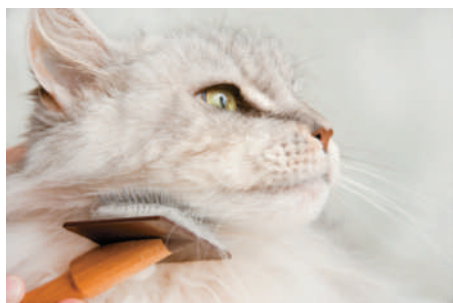
One of the most important and well-known specialized features of the cat is the **righting reflex**. This reflex is the cat's innate ability to land uninjured on its feet after it falls. However, this does not mean that a cat cannot become seriously injured after experiencing a long fall, or a fall too short to allow the cat enough time to right itself.

righting reflex

the ability of a cat to right itself and land on its feet after it falls

did you know?

As a cat falls, the righting reflex allows the cat to orient its body so that its paws are facing the ground. This reflex is activated even if the cat falls after being blindfolded or falls in complete darkness. As a cat falls, it may also spread out its body to increase drag and slow the fall. Cats can often survive a fall of up to six stories in height. Humans, on the other hand, can only usually survive a fall from about two stories.



Courtesy of Sandy Clark

FIGURE 33-8

Cat owners should regularly groom their animals.

fur ball

a clump of fur ingested by a cat during grooming that is not able to pass through the digestive system

Grooming

Although cats routinely groom themselves, cat owners should also groom their cats (Figure 33-8). Longhaired cats require regular, sometimes daily grooming to remove excess hair, whereas short-haired cats may need to be groomed only once a week. Not only does regular grooming improve the coat and minimize the risk of **fur balls**, it may also help the owner detect swollen areas, fleas, and other parasites on the cat's body. Fur balls are common in cats because of the constant grooming that cats perform. Fur balls occur when the cat

has ingested too much hair for the digestive tract to easily remove. This can occur at any time during the year but occurs most frequently in the warmer months when a cat is shedding its winter coat. Fur balls obstruct the stomach and intestine. Cats will ingest grass or use other means to help regurgitate fur balls.

did you know?

Cats spend about 30% of their time cleaning themselves. This is partially due to their natural instinct to hunt. Wild cats carefully clean themselves to remove the blood and scent of the last animal they killed. If not, the scent would alert prey during their next hunt.

Feline Reproduction

Cats usually reach puberty, or sexual maturity, at approximately 6 months of age, although maturity can be reached as young as 4 months of age. At puberty, the feline reproductive cycle, also called the estrous cycle, begins and repeats every 2–3 weeks. The breeding period for cats is controlled by the number of daylight hours, which explains why most cats typically breed in the spring and summer months, when the days are longer. However, artificial indoor lighting can alter a house cat's sense of daytime length, and many indoor cats will breed all year long. Female cats are **induced ovulators**. This means that ovulation, or the release of eggs from the ovaries, does not occur without the stimulation of mating.

Parturition, or the birth of offspring, occurs 60–65 days after copulation. Kittens are born with their eyes closed. Their eyes will usually open when

induced ovulator

an animal that releases eggs when stimulated during the mating process

parturition

the birth of offspring

TABLE 33-2

Reproduction Facts about Cats

Sexual Maturity	Males: 9–12 months/ Females: 10 months
Gestation	60–65 days
Litter Size	2–11 kittens
Age at Weaning	7–8 weeks
Socialization Period	2–7 weeks
Age When Eyes Open	7–10 days

the kittens are between 7–10 days old. Table 33-2 presents an overview of the reproductive lives of cats.

Sexual Behavior

When unneutered male cats reach sexual maturity, they will spray urine to mark their territory. Female and neutered male cats may still spray urine, but they are far less likely to do so than an unneutered male. To stop this behavior, cats should be spayed (female) or neutered (male). Spaying and neutering will help reduce aggressive behavior, prevent the birth of unwanted kittens and feline overpopulation, and reduce the risk of diseases, such as Feline Leukemia (FeLV) and Feline AIDS or Feline Immunodeficiency Virus (FIV). Cats should be spayed or neutered before they reach sexual maturity, which may be as early as 4 months of age.

Feline Health and Care

The daily care of household cats involves three basic responsibilities: feeding, grooming, and changing litter. Cats require routine visits to the veterinarian, including at least an annual checkup.

**FIGURE 33-9**

Cats should have an annual veterinary examination.

During checkups, the veterinarian may weigh the cat, perform a dental examination, check for parasites, perform an examination on the heart and musculoskeletal system, and check the skin, coat, ears, and eyes for any abnormalities (Figure 33-9). The musculoskeletal system includes the muscles, bones, and joints.

All cats should receive the following four vaccinations: feline panleukopenia virus, feline calicivirus, feline herpesvirus, and rabies. These four vaccinations are recommended for all cats because the diseases they prevent are serious and easily transmissible. Vaccines for other diseases are prescribed by veterinarians on a case-by-case basis. Other recommended vaccinations depend on many factors including age, health, and the risk of exposure to pathogens.

Kittens should have a veterinary exam when they are between 6 and 8 weeks of age. The veterinarian will vaccinate the kitten, perform a physical examination, and test for diseases, parasites, or other health problems.

Feline Health Problems

There are several common feline health problems, including intestinal worms, heartworms, ticks and fleas. Many cat diseases are caused by bacterial or viral infections.

Internal Parasites One of the most common problems in cats is intestinal worms. Worms, including roundworms, hookworms, and tapeworms, typically attack a cat's digestive system. Roundworms are long, white, and stringlike. Hookworms are very thin, approximately half an inch in length, and attach themselves to the intestinal wall of the cat. Tapeworms are typically cream-colored with a ribbonlike appearance, and are 6 to 24 inches in length. Infestations occur after the worm or its larvae are swallowed by the cat. Worm infestations can be prevented by administering a routine dewormer.

Cats can become infected with heartworms. Mosquitoes are the transmitter of the heartworms from the blood of an infected animal. These worms are controlled by using a monthly treatment, either orally or topically. If a cat is infected with heartworms, depending on the extent of the infection, the heartworms can show up on an X-ray. Heartworms cause damage to the lungs and heart, and can be fatal if not treated. Severe cases of heartworm disease will cause coughing and shortness of breath in cats.

External Parasites Cats are susceptible to the same external parasites that attack most companion animals. Fleas and ticks cause itching, hair pulling, bald spots, and a general unthriftiness. Cats can be treated with either a topical solution or with a monthly oral treatment to help control external and internal parasites.

Rabies Rabies presents an increasing threat to domestic cats. More domestic cats are infected with rabies than any other domestic animal. Not only is rabies a major threat to cats, it is also an important

human health concern because rabies is a zoonotic disease. Rabies can be spread to humans through exposure to an infected cat. As a result, many states require cats to receive a rabies vaccination yearly.

Feline Immunodeficiency Virus (FIV) Feline Immunodeficiency Virus (FIV) is a virus that infects cats. Approximately 1.5 to 3 percent of cats that appear healthy are infected. There is no cure for FIV. Biting is the most common way the virus is spread. A large number of free-roaming, aggressive cats, especially males, are infected. Cats with FIV can appear normal for years, but the virus depletes the immune system of the cat, until finally the cat is unable to fight off infections.

Although this virus attacks the cat in the same way that Human Immunodeficiency Virus (HIV/AIDS) attacks humans, FIV cannot be transmitted from cats to humans. New cats should be tested for this virus and if found to be negative, should be vaccinated against this virus. However, if the cat is positive for the disease, there is no cure.

Feline Leukemia Virus Feline leukemia virus (FeLV) is a virus which infects the immune system of the cat, much like feline immunodeficiency virus (FIV). The feline leukemia virus produces an enzyme which inserts copies of the virus's genetic material into the cat's normal cells, which then begin producing copies of the virus. Transmission of the virus occurs through contact with an infected cat, such as bite wounds, mutual grooming, and even through sharing a litter box or a feeding dish. Because the feline leukemia virus weakens the cat's immune system, the cat becomes susceptible to other illnesses, including cancer. There is currently no cure for the feline leukemia virus.

Feline Panleukopenia Feline panleukopenia, commonly known as feline distemper, is caused by the feline parvovirus. This virus is spread through contact with an infected cat's bodily fluids, and can be spread through shared bedding or food dishes.

The virus attacks the cat's intestinal tract and weakens the cat's immune system.

Cat Scratch Disease Cat Scratch Disease, or Cat Scratch Fever, is a zoonotic bacterial disease that is spread to humans through contact with an infected cat. Most people who have Cat Scratch Disease have been bitten or scratched by an infected cat. A mild infection usually develops at the point of injury. Cats that carry the disease show no signs of illness, so it is difficult to determine which cats can spread the disease. To reduce risk of infection, avoid any activity with cats that may lead to scratching or biting, and wash bites and scratches immediately if they do occur.



© Image Source

FIGURE 33-10

Cat owners can provide toys for their cats to encourage them to play.

Feline Training and Toys

Although cats are sometimes considered solitary animals, they do enjoy being affectionate and playing with their owners. Many owners choose to provide their cat with small toys to encourage physical activity (Figure 33-10). Most cats will treat these toys as if they were prey, pouncing on and chasing after the toys.

Litter Boxes

One of the most important things to train a cat to do is to use a litter box. A litter box is a simple and convenient way for a cat to dispel its urine and feces. Litter box training for most cats is simple and easy, and most kittens and cats will catch on quickly. As soon as the cat or kitten is brought home for the first time, take it to the litter box and gently dig its front paws in the litter. Continue to return the cat to the litter box until it actually uses it. By this time, most cats will understand the purpose of the litter box.

A litter box also requires routine maintenance. Litter boxes need to be checked and cleaned at least once a day. Changing the litter approximately every five days is typically a good routine.

Cats will often refuse to use an unclean, smelly litter box. Cats will also often refuse to use the same litter box with other household cats. There are several available types of litter boxes, including covered and uncovered. Most cats simply prefer a litter box that is located in a quiet, secluded area of the house away from human traffic.

Scratching is a natural behavior for cats, and it isn't possible to stop a cat from scratching. A cat will scratch to mark its territory, exercise, or simply for the pleasure of scratching. However, most pet owners become annoyed when their cat uses furniture as a scratching post. To deter the cat from scratching furniture, provide it with an appropriate scratching post (Figure 33-11). A good post is tall enough for the cat to extend its entire body to scratch. Because cats typically scratch in a vertical motion, the post should be made with a material that shreds vertically.

Many cats enjoy using cat houses, sometimes referred to as cat trees. A cat house is used for recreation and entertainment, and also provides a cat with a sense of privacy. Cats will use the cat house to play, scratch, relax, or take a nap.



© iStockphoto/Xseon

FIGURE 33-11

It is natural for cats to scratch. They should be provided with a scratching post for this behavior.

Summary

As a companion animal, cats make excellent household pets. From ancient Egypt to our modern society, cats have continued to be valuable companions for people. Although cat personalities can be quite varied, most cats display a calm, independent disposition and are valued for their low maintenance requirements. Owning a cat requires a basic knowledge of feline behavior, common health problems and vaccinations, and appropriate care and training for a domestic cat.

Quick Facts

- Cats have been interacting with humans for at least 9,500 years and have been domesticated for at least 4,000 years.
- The typical domestic cat weighs between 6 and 15 pounds, and has a life span of approximately 12 to 18 years.
- Some domestic cats are purebred, but over ninety percent of cats are a mixed breed and not classified by breed.
- Feral cats are wild, non-domesticated cats.
- Domestic cats display two types of normal communication: meowing and purring.
- When faced with a tense or threatening situation, cats will display three types of defensive communication: hissing, growling, and arching their backs.
- Spaying or neutering is the removal of all or part of the reproductive system.
- Cats have some specialized parts of their anatomy, including the Jacobson's organ, papillae on the tongue, retractable claws, and scent glands between the toe pads.
- One of the most important specialized features of the cat is the righting reflex.
- The cat reaches puberty at about 6 months of age, but puberty may occur as early as 4 months.
- Cats require routine visits to the veterinarian, beginning at 6–8 weeks of age.
- Cats are susceptible to the same external parasites that attack other companion animals, especially fleas and ticks.
- Many diseases of cats are caused by viruses and bacteria.
- Recommended vaccinations for cats are for feline panleukopenia virus, feline calicivirus, feline herpesvirus, and rabies.
- One of the most common health concerns for cats is worms. Worms typically attack a cat's digestive system and are known as internal parasites.
- Not only is rabies a major threat to cats, it is also an important human health concern, as the virus can be spread to humans.
- Many cat diseases are serious and some are zoonotic, such as cat scratch fever.
- Scratching is normal behavior for cats, and a scratching post should be provided.
- It is very important to train a cat to use a litter box so that carpet and flooring do not get soiled.

Student Learning Activities

1. Visit a small animal hospital or an animal shelter and interview the personnel.
2. Have students choose a breed of cat to research and give a report to the class.
3. Make photographs of neighborhood cats. Prepare a notebook and try to determine their breed or the breed that they most resemble. Make notes on characteristics of the breed.
4. Have a knowledgeable person talk to the class about responsible pet ownership.
5. Prepare a list of materials and expenses required to properly care for a cat.

Discussion Questions

1. Explain how cats became domesticated.
2. List three interesting facts about the cat's body.
3. Explain how to train a cat to use a litter box.
4. Describe methods of defense for cats.
5. Compare and contrast the effects of spaying or neutering a cat.

Review Questions

True/False

1. Cats are born with the instinct to know how to use a litter box.
2. Cats were first used by humans as house pets.
3. Cat scratch fever may be passed from cat to human.
4. Consumers in the United States spend more money on cat food than on baby food.
5. Ninety percent of cats are classified into different breed groups.
6. Ten percent of the cat's bones are in the tail.
7. A male cat is known as a tom.
8. The Jacobson's organ is used in the sense of smell.

Multiple Choice

1. The Jacobson's organ can be found inside the _____.
 - a. ear
 - b. nasal cavity
 - c. mouth
 - d. tongue
2. A female cat is known as a _____.
 - a. queen
 - b. feline
 - c. felis
 - d. princess
3. Which of the following is not a defense method displayed by cats?
 - a. hissing
 - b. standing on hind legs
 - c. growling
 - d. arching of the back
4. _____ cats are also known as wild cats.
 - a. Ferrous
 - b. Felis
 - c. Tom
 - d. Feral
5. Which of the following are the main communication noises made by cats?
 - a. purring and scratching
 - b. meowing and spraying
 - c. meowing and purring
 - d. purring and spraying

Completion

1. If a disease is _____, it can be spread from animals to humans.
2. _____ is when a female cat gives birth.
3. When a cat is _____, its front claws are removed.
4. The instinct that helps a cat right itself is called _____.
5. A _____ provides the cat with a place to rest, scratch and play.

Short Answer

1. Which disease infects cats in a way that is almost identical to the way that HIV infects people?
2. List and describe three diseases that affect cats or kittens.
3. How were cats used and domesticated in ancient Egypt?
4. What is the scientific classification for cats? List all, starting with kingdom through species.
5. What are the four qualities typically used to describe feline behavior?



Section 11

EXOTIC ANIMALS

CHAPTER 34 Rabbit Production

CHAPTER 35 Large Game Animals

CHAPTER 36 Ratites

CHAPTER 37 Game Birds

CHAPTER 38 Llamas and Alpacas

FFA AND 4-H CONNECTION

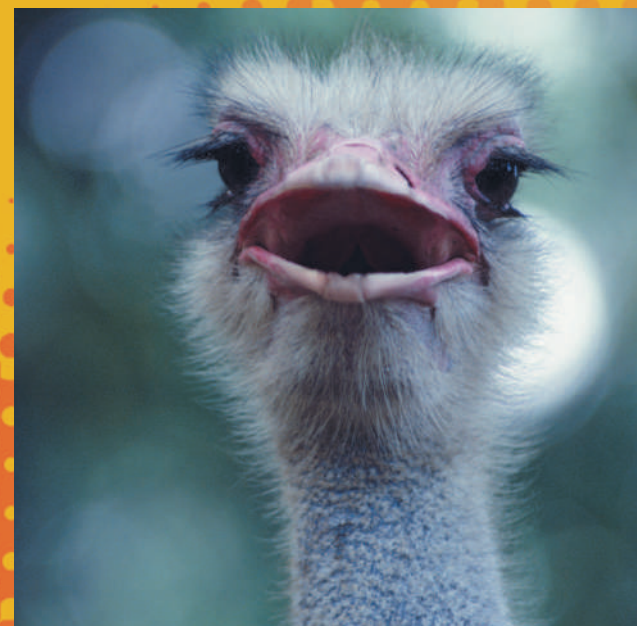


The following is a partial list of activities in which a student may participate using knowledge obtained in an exotic animal program. Students should consult local and state youth organizations, such as FFA and 4-H, to determine programs available in their area.

- **Agricultural Sales**
- **Animal Nutrition**
- **Farm Business Management**
- **Livestock Judging**
- **Meats Evaluation and Technology**

Proficiency Awards (FFA)

- **Animal Shows and Exhibitions**
- **Diversified Agricultural Production**
- **Diversified Livestock Production**
- **Small Animal Production and Care**
- **Specialty Animal Production**
- **Veterinary Medicine**
- **Wildlife Production and Management**





CHAPTER 34

Rabbit Production



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe the common breeds of rabbits.
- List the uses of rabbits by breed.
- Outline a management program for rabbits.
- Outline a production program for rabbits.
- Discuss marketing of rabbits.



KEY TERMS

hare	American Rabbit	kindling
kit	Breeders	nesting box
buck	Association	hutch
doe	(ARBA)	fryer
feed conversion	breed standard	
pelt	herbivore	
	coprophagy	

LANGUAGE CONNECTION

English	French	German	Latin	Spanish
Herd	Troupeau	Herde	Grege	El Rebaño
Growth	Croissance	Wachstum	Incrementum	El Crecimiento
Rabbit	Lapin	Kaninchen	Lepus	El Conejo
Lean	Maigre	Mager	Macer	Magro

Classification of Rabbits

Kingdom	–	Animalia
Superphylum	–	Chordata
Phylum	–	Vertebrata
Class	–	Mammalia
Order	–	Lagomorpham
Family	–	Leporidae

Rabbits in the United States

While the United States has a number of native rabbit species, the ancestor of the domesticated rabbit that is used for food, fur, and pets is the European wild rabbit. The European rabbit was introduced to North America by early European settlers who used the rabbits for food and fur. Both rabbits and hares are members of the Leporidae family, commonly known as lagomorphs. Native North American rabbits include the cottontail rabbit and jackrabbits. Jackrabbits are actually **hares** which give birth to fully furred **kits** with open eyes that can hop shortly after birth. Rabbits give birth to furless, deaf, and blind kits, which are totally dependent on their mother for 10 days or more. A kit is a baby rabbit, although they are widely referred to as bunnies.

hare

a type of lagomorph that gives birth to fully furred kits

kit

a baby rabbit or hare

buck

a male rabbit

doe

a female rabbit

Rabbit TerminologyMale rabbit or hare = **buck**Female rabbit or hare = **doe**Immature rabbit or hare = **kit****Rabbit Production**

Rabbits are used for meat, fur, and research, as well as pets in the United States. Rabbits are a more important source of meat in Europe and Asia than in the United States. France is the number one producer and consumer of rabbits in the world. Rabbits are an excellent alternative to traditional livestock, especially in urban areas. A small area such as a balcony and cage are all that is needed to house a rabbit. As long as the cage remains clean, there is little to no smell associated with the rabbit.

Because the doe's milk is rich in nutrients, kits can double in size in only 6 days as compared with 14 days for piglets, 47 days for calves, and 160 days for humans. Rabbits are also known for their high rate of reproduction, and are considered to be among the most productive of all agricultural animals.

Meat Production and Use

Rabbits produce a nutritious white meat that is high in protein and low in fat and cholesterol. Rabbit meat is lower in cholesterol than chicken, turkey, beef, or pork. The per capita consumption of rabbit meat in the United States is only about half an ounce per person per year. Beef consumption in the United States amounts to almost 90 pounds per person per year.

Rabbit meat can be substituted for chicken in many recipes. It is a healthy alternative to more fatty meats. Rabbit meat has also been used in a variety

feed conversion

the amount of feed consumed per pound of gain

pelt

the skin of an animal

American Rabbit Breeders Association (ARBA)

an organization that registers and sanctions rabbit shows, breeds, and organizations throughout the United States.

of special diets including low sodium and weight reduction diets, and diets for people with heart disease.

The **feed conversion** is much higher in rabbits than in most livestock. Feed conversion is the amount of feed consumed per pound of gain. After being given comparable amounts of feed and water, a rabbit would be able to produce six pounds of meat while a steer would only produce 1 pound of meat. Rabbits are harvested at about eight weeks of age when they weigh about 4–6 lbs.

Fur Production

Although most rabbits in the world are raised for meat purposes, some of the skin or **pelts** are used in fur production, especially if they are white in color. The pelts are usually considered a by-product of the meat operation and in most cases, discarded. Rabbits with colored pelts bring lower prices. Commercial rabbitries produce only white rabbits.

Companion Animals

Many hobby rabbit owners raise rabbits as companion animals or for show. Hobby breeders and owners of show rabbits are represented by a number of organizations that facilitate and organize rabbit shows. **The American Rabbit Breeders Association (ARBA)** registers and sanctions rabbit shows, breeds and organizations throughout the United States.

Other Uses for Rabbits

Rabbits have many other uses. Youth projects using rabbits are very popular. Rabbits are used extensively to feed pets such as snakes. They are also used

for research at medical schools, laboratories, and hospitals. Rabbits are used widely in medical experimentation and testing due to their docile nature. They are easily restrained, cheap to maintain, and breed prolifically. Rabbits are used in the testing of cosmetics and household cleaning chemicals. They are also used in research for cardiovascular disease, skin disorders, immune response, and antibody production for use in vaccines.



Science Connection

One of the most famous uses of rabbits in research was for the development of a rabies vaccine by Louis Pasteur in 1885.

Breeds

Forty-seven breeds of rabbits are recognized by the ARBA. Six factors must be considered for breed standards: color, shape, wool, hair, fur, and type. Each breed has **breed standards** published in the “ARBA Standard of Perfection.” Breeds are identified as small, medium, or large, based on their weight at maturity (Table 34-1). The largest breed of rabbit in the United States is the Flemish Giant. Flemish Giants can weigh over 20 pounds.

breed standard

a set of six factors that describe the characteristics of a particular breed: color, shape, wool, hair, fur, and type



Science Connection

Crossbred rabbits can benefit from hybrid vigor. Animals that are crossbred often inherit the best qualities of each breed.



Photo by Isabelle Francais

FIGURE 34-1

The Polish breed is a miniature rabbit breed.



Photo by Isabelle Francais

FIGURE 34-2

The Dutch breed is a small breed rabbit.



Photo by Isabelle Francais

FIGURE 34-3

The English Spot is a medium-sized rabbit breed.

TABLE 34-1

Rabbit Breeds

Dwarf or Miniature
Britannia Petite
Netherland Dwarf
Himalayan
Dwarf Hotot
Polish (Figure 34-1)
Jersey Wooly
Holland Lop
American Fuzzy Lop
Mini Rex
Small
Dutch (Figure 34-2)
Tan
Florida White
Silver
Havana
Mini Lop
Medium
English Spot (Figure 34-3)
Standard Chinchilla
English Angora
Lilac
Silver Martin
Belgian Hare
Rhineland
Harlequin
Sable
Satin Angora
French Angora
Rex



Photo by Isabelle Francals

FIGURE 34-4

The Californian is a large breed rabbit.



Photo by Isabelle Francals

FIGURE 34-5

The Checkered Giant is a giant rabbit breed.



Courtesy of the American Rabbit Breeders Association

FIGURE 34-6

The New Zealand white rabbit is one of the most popular breeds used for meat.

TABLE 34-1 (Continued)

Large
Beveren
Californian (Figure 34-4)
Hotot
Palomino
Satin
Cinnamon
Crème d'Argent
Champagne d'Argent
American
American Chinchilla
English Lop
New Zealand
Silver Fox
Giant
Giant Angora
French Lop
Checkered Giant (Figure 34-5)
Giant Chinchilla
Flemish Giant

Breed selection should be based on expected use. Commercial rabbitries that produce rabbits for meat generally use New Zealand, Californian, or crosses of these two breeds (Figure 34-6). Photographs and more information about each individual breed can be found at the ARBA website (www.arba.net).

Table 34-2 lists some of the common breeds of rabbits and their primary uses.

TABLE 34-2

Common Breeds of Rabbit and Their Uses

Breed	Size	Mature Weight (lbs)	Major Uses
Angora	Medium	9-12	Wool and meat
American Chinchilla	Medium	9-12	Fur
Californian	Medium	8-10.5	Meat and show
Champagne d'Argent	Medium	9-12	Meat and show
Checkered Giant	Large	11 and over	Show and fur
Dutch	Small	3.5-5.5	Show and laboratory
English Spot	Medium	5-8	Meat, show and laboratory
Flemish Giant	Large	13 and over	Meat and show
Himalayan	Small	2.5-5	Show and laboratory
New Zealand	Medium	9-12	Meat, show and laboratory
Polish	Small	3-4	Laboratory

herbivore

an animal that has a diet consisting mainly of plant-based food

Feeding and Nutrition

Rabbits are **herbivores**, meaning their diets come mainly from plant sources. When fed well-balanced rations, rabbits can efficiently convert about every three to four pounds of feed into one pound of meat. Dry forages such as hay usually make up between 40 and 80 percent of a rabbit's diet.

Rabbits need energy, fiber, and protein food sources. Common energy feeds include corn, wheat, oats, barley, grain sorghum, rye, and buckwheat. Plant fiber is necessary in rabbit diets for digestive health. Diets with crude fiber levels lower than 6 to 12 percent of the ration have been shown to increase the incidence of diarrhea and enteritis. Protein supplements such as soybean meal and fish meal have produced the best growth. Alfalfa is a commonly used protein source for rabbits, as they can digest

FIGURE 34-7

Pelleted feed is the easiest way to ensure that rabbits are receiving the proper diet.



Delmar/Cengage Learning

coprophagy

the act of an animal eating its own feces

75 to 85 percent of alfalfa protein. Pelleted feeds are typically preferred by rabbits and are commonly used in rabbitries. Pelleted feeds are the most practical and convenient form of feed (Figure 34-7). The rate of gain and feed efficiency in rabbits is improved with pelleted rations, and less food is wasted. Commercial feeds are usually fortified with the vitamins and minerals rabbits need.

Rabbits practice **coprophagy**, which is the ingestion of their own feces. Coprophagy is similar to rumination in the sense that it allows the feedstuffs to pass through the digestive system twice. It is believed that coprophagy provides some additional digestion of nutrients. Coprophagy is a normal practice in rabbits and does not indicate a nutritional deficiency.

Digestion

Rabbits are referred to as hindgut fermenters. This is the same digestive classification as horses and other equine species. The rabbit's digestive system looks primarily the same as other mammals' except for the very large cecum. The cecum allows the rabbit to process large amounts of high fiber plant materials. The cecum acts as a large fermentation vat, such as the rumen in ruminant animals (i.e. cow, goat).

kindling

giving birth to kits

nesting box

an area in the cage where the doe will have the kits

Breeding

Rabbits are known for their prolific reproductive ability. The average gestation period for rabbits is 28–31 days. Litter size will vary by breed, but breeds used for commercial meat production average eight young (kits) per litter.

Does can be bred from four to eight months of age, depending on the breed. Does that are in good physical condition can be rebred two weeks after **kindling** (giving birth). This makes it possible for a doe to produce nine litters per year in intensive production systems. So, a prolific doe could produce 72 kits per year. In turn, her female offspring can begin giving birth the same year – at just 6 months of age.

Kindling

Prepare for kindling by providing a **nesting box** in the cage about 27 days after the doe is bred (Figure 34-8). The buck should be moved out of the pen soon after breeding the doe. Bucks have been known to kill the kits. The nesting box should contain bedding materials, such as clean straw or wood shavings. The doe will pull hair from her body to line the nest.

Kindling usually occurs at night. Does in good physical condition rarely have problems kindling, but are often nervous afterwards and should not be disturbed until they have calmed down.

FIGURE 34-8

Nesting boxes should be provided to protect newborn rabbits from the elements.



Courtesy of Caleb Allred

Kits, or kittens (newborn rabbits), usually open their eyes about 10 or 11 days after birth. Kits will start to eat solid feed at about 19 to 20 days of age. They will come out of the nesting box at this time for feeding. Kits should not be handled until they come out of the nesting box. The doe may become upset with the smell a human leaves behind in the nesting box and kill her offspring. Rabbits may be weaned between four and eight weeks of age.

Handling Rabbits

Do not lift rabbits by their ears or legs. To properly lift a rabbit, grasp the loose skin over the shoulders with one hand and support the weight of the rabbit with the other hand under the rump (Figure 34-9). Small and medium sized rabbits may be picked up by placing the palm of the hand under the abdomen and lifting.



History Connection

In the spring of 1979, President Jimmy Carter was on a fishing trip in his hometown of Plains, Georgia. While alone in his boat, a rabbit being chased by hounds jumped into the pond and swam aggressively toward President Carter's boat, hissing menacingly. President Carter splashed the water with his paddle to keep the feisty rabbit away. A White House photographer on the shore snapped a photograph and the legend of the "killer rabbit" was born. The Washington Post headline read "President Attacked by Rabbit."

FIGURE 34-9

The proper way to pick up a rabbit is to grasp the skin on the back of the neck with one hand while supporting the rest of the body with the other hand.



Courtesy of Lacy Allred

Maintaining Rabbit Health

Good sanitation, proper management, adequate diet, and plenty of clean, fresh water will help a grower maintain healthy rabbits. Observe the rabbit herd closely for signs of disease outbreak. Any animals that appear to be sick should be isolated from the others. Dead rabbits should be removed immediately.

Remove manure and old bedding on a regular basis. Protect water and feed from contamination with urine and feces. Clean watering and feeding equipment frequently.

Do not overcrowd rabbits. When rabbits are overcrowded, their resistance to disease is lowered and illness may spread rapidly through the herd. After an outbreak of disease or parasites in the rabbitry, clean and disinfect hutches and equipment.

Parasites

Rabbits are susceptible to a number of both internal and external parasites, but only a few are of economic importance to rabbit breeders. The internal parasites include worms and coccidiosis. The external parasites include mites and, to a lesser degree, fleas and ticks.

Coccidiosis The disease that is thought to cause the greatest loss of rabbits is *coccidiosis*, a treatable disease caused by the coccidia protozoa that can infect the liver and intestinal tract. *Coccidiosis* can cause diarrhea, an enlarged liver, slow or no weight gain, weight loss, and death.



Science Connection

Protozoa are single-celled microscopic organisms that have a true nucleus. The protozoa are a diverse group. Some, such as coccidia, are parasites of animals and humans.

Worms Unlike many other mammals, rabbits are usually only infested with pinworms and tapeworms. Both of these worms can be easily treated with commercial dewormers. Pinworms may occasionally be seen on fresh feces.

Mites There are two types of mites that affect the health of the rabbit. They are ear mites and fur mites. Ear mites live in the ear canal and cause the rabbit to scratch its ears. Prolonged exposure to ear mites may cause permanent ear damage and hearing loss. There are medicines available from a veterinarian for the treatment of ear mites.

The fur mite lives in the fur of the rabbit and can cause itching, which prompts the rabbit to scratch itself, and may result in skin lesions in places where all the fur has been stripped off. Fur mites make the animal uncomfortable and cause a reduction in eating and weight loss. Most rabbits affected with fur mites will have an uneven coat of fur due to scratching.

Fleas and Ticks Rabbits are not normally affected by fleas and ticks, but they can become a problem quickly under the right conditions. Normal grooming can alert the owner to the presence of these pests.

Other Veterinary Care Rabbits kept as pets need to have pieces of wood or some other hard substance to chew on. This helps keep their front teeth worn down. If the teeth are not worn down naturally, they will have to be filed down, at much discomfort to the rabbit and stress to the owner. Also, rabbit owners should keep the toenails of their rabbits trimmed. Untrimmed toe nails can cause painful scratches to the handlers and can cause pain and discomfort to the animal. If toenails are not trimmed they can curl around and pierce the pads of the feet, requiring veterinary attention.

Other Disorders

The most common nutritional disease affecting breeding rabbits is pregnancy toxemia or ketosis. The rabbits that are most commonly affected by

this are does having their first litter of kits. Ketosis usually occurs during the last week of pregnancy and is more prevalent in obese (excessively fat) females.

Glaucoma, a disease of the eye caused by too much pressure in the eyeball, also affects rabbits. This makes rabbits excellent study subjects for new glaucoma treatments. If the rabbit starts to develop glaucoma, the eye will begin to turn a cloudy, bluish color, with the rabbit eventually losing sight in the affected eye.

Facilities and Equipment

The facilities and equipment needed to care for and properly maintain a rabbit can be very simple to elaborate. Rabbits need a safe, dry place in which to grow. Included in the equipment should be a hutch, nesting box, feeder, and water container.

In hot weather, rabbits must be kept cool. Good ventilation is necessary in the rabbitry, as rabbits can die from overheating. Pregnant does and newborn kits are especially susceptible to hot weather. It is important to monitor each rabbit closely and move any rabbit showing signs of heat stress to a cooler area.

Make sure rabbits are kept warm during cold weather. Rabbits generally have a higher tolerance for cold weather than hot weather, but they should still be protected from harsh winter weather.

Hutches

Hutches are small pens for housing rabbits (Figure 34-10). These are usually made of wood and/or wire. Provide about six square feet of hutch space per rabbit. In mild climates, hutches may be outside if shade is provided by trees or other sources. The hutches must be designed to provide protection from extreme temperatures. In very cold weather, hutches are best kept inside a building or shed. Wire cages of

hutch

a cage for small animals such as rabbits

FIGURE 34-10

A well-built rabbit hutch includes raising the hutch off the ground and providing wire mesh flooring for easy cleanup.



Courtesy of Lacy Allred

various designs are available from commercial firms. Self-cleaning wire cages require no bedding and are easy to maintain. Wire mesh floors are usually used in self-cleaning hutches.

Nesting Boxes

Nesting boxes provide seclusion for the doe when kindling, and provide protection for the litter. These boxes can also provide protection from rain and cold weather for adult rabbits. Several types of nesting boxes made from different materials may be used. Rabbit nesting boxes are generally made of wood. Nesting boxes should be well-drained and well-ventilated. In cold weather, an insulated nesting box will provide protection for the young rabbits.

Water

Rabbits need access to clean, fresh water at all times. Water may be provided in a number of ways. The most common is a water bottle attached to the side of the hutch (Figure 34-11). A dish can be used to provide water as well. In the winter, the water should be protected from freezing.



Courtesy of the FFA

FIGURE 34-11

It is important for rabbits to have access to clean water at all times.

Marketing Rabbits

The value of the rabbit meat and pelt industry is small, especially when compared to other livestock production enterprises. In Europe and Asia, the consumption of rabbit meat is much more common. In the United States, only certain areas of the country have a ready market to sell rabbits. Commercial rabbitries usually sell **fryers** (young rabbits, 8–12 weeks of age) to processors who market the meat. Rabbits with colored pelts bring lower prices, so commercial operations usually raise only white-pelted rabbits.

Rabbit manure makes an excellent fertilizer and can be a profitable by-product. Manure can be sold to gardeners or garden suppliers. Rabbit manure can also be used to raise worms.

Additional markets for rabbits and rabbit products include the reptile feeder market and the angora wool market. The wool market is very limited in the United States, and the value of this market is insignificant.

fryer

a young meat rabbit between
8 to 12 weeks of age

Summary

There are 47 ABRA-recognized breeds of rabbits. Modern domestic breeds in the United States are descendents of the European wild rabbit. The major agricultural use of rabbits in the United States is for meat production. Rabbit meat is high in protein, and low in calories, cholesterol, and fat.

Rabbits are herbivores. Most of their diet comes from plants. Rabbits are hindgut fermenters. Many commercial rabbitries use complete pelleted feeds for rabbit rations. A supply of fresh, clean water should be available for rabbits at all times.

Good sanitation should be practiced in the rabbitry for disease control. Manure and soiled bedding should be removed. Sick animals should be isolated from the herd. Dead animals should be removed immediately.

Depending upon the climate, buildings may be needed to protect rabbits from extreme weather conditions. Commercial rabbitries generally use wire cages and automated feeding and watering equipment. No human contact with the new kits is recommended. Nesting boxes are used during kindling and nursing to protect the doe and her litter.

Commercial rabbitries sell fryers to processors. The most popular breeds used for meat are the New Zealand White and the Californian. Consumption of rabbit meat is very low in the United States.

Quick Facts

- Hares and rabbits are closely related. Both are in the same family referred to as lagomorphs.
- Jackrabbits are actually hares which give birth to fully furred kits with open eyes that can hop shortly after birth.
- Rabbits give birth to furless, deaf, and blind kits, which are totally dependent on their mother for 10 days or more.
- Rabbits produce a nutritious white meat which is high in protein and low in fat, cholesterol, sodium, and calories.
- Alfalfa is a commonly used protein source for rabbits because they can digest 75 to 85 percent of alfalfa protein.
- Pelleted feeds are commonly used in rabbitries.

- Mature, domestic female rabbits come into heat every three weeks.
- The ancestor of the domesticated rabbit that is used for food, fur, and pets in the United States is the European wild rabbit.
- Rabbits are used for meat and fur production, as well as pets. They are used in research and for snake food.
- Forty-seven breeds of rabbits are recognized by the ARBA.
- Commercial rabbitries that produce rabbits for meat generally use the New Zealand breed, the Californian breed, or crosses of these two breeds.
- Rabbits are herbivores, meaning their diet comes mainly from plant sources.
- Rabbits have an excellent feed conversion ratio.
- The per capita consumption of rabbit meat in the United States is very low.
- Rabbits practice coprophagy; the practice of eating their own feces.
- Rabbits are hindgut fermenters, similar to horses, allowing them to digest roughages.
- Almost all commercially produced rabbits are white due to the preferred color of the pelt.
- Rabbits are known for their prolific reproduction, with a gestation period of 28–31 days.
- A doe can produce nine litters per year in intensive production systems, averaging 8 kits per litter, and 72 kits per year.
- Lift rabbits by grasping the loose skin over the shoulders with one hand and support the weight of the rabbit with the other hand under the rump.
- Good sanitation, proper management, adequate diet, and plenty of clean, fresh water are keys to raising healthy rabbits.
- Rabbits are susceptible to a number of internal and external parasites, but only a few are of economic importance.
- Coccidiosis, a disease caused by the coccidia protozoa, is responsible for the greatest loss in rabbit production.
- The facilities and equipment needed to care for and properly maintain a rabbit can be very simple to elaborate, but must provide protection from the elements.
- Equipment should include a hutch, nesting box, feeder, and water container.
- Rabbit manure can be a profitable by-product. Rabbit manure is used as a fertilizer and to raise worms for fishing, etc.

Student Learning Activities

1. Have a commercial rabbit producer talk to the class and describe the business.
2. Prepare and present oral reports on commercial rabbit production.
3. Prepare a PowerPoint display on the breeds of rabbits.
4. Plan and conduct a Supervised Agriculture Experience (SAE) program in rabbit production.
5. Research and compare the digestive systems of rabbits, horses, and pigs.

Discussion Questions

1. Explain the uses of rabbits in the United States.
2. What is considered the most practical form of feed for rabbits and why?
3. List good management practices to follow at kindling time.
4. List and describe several good management practices in a disease control program for rabbitries.
5. How do rabbit kits and hare kits differ?

Review Questions

True/False

1. The ancestor of the domestic rabbit in the United States is a wild rabbit found in the southwestern part of the United States.
2. Rabbits are herbivores.
3. The primary use of rabbits in the United States is for wool production.
4. The gestation period for rabbits is about 31 days.
5. A doe will pull out her fur to line the nesting box at kindling time.

Multiple Choice

1. Both rabbits and hares are members of what family?
 - a. Ochotonidae
 - b. Procavia
 - c. Leporidae
 - d. Litopterna
2. The term for a rabbit cage is:
 - a. shed
 - b. hutch
 - c. coop
 - d. house
3. The largest rabbit breed in the United States is the _____.
 - a. Flemish Giant
 - b. New Zealand
 - c. Angora
 - d. American Shorthair
4. _____ is the number one producer and consumer of rabbits.
 - a. Hungary
 - b. United States
 - c. France
 - d. Great Britain
5. One correct way to pick up a rabbit is by its _____.
 - a. ears
 - b. body
 - c. tail
 - d. feet

Completion

1. Crossbred rabbits may display _____, in which the best qualities of each breed are inherited.
2. The disease that causes the greatest loss of rabbits is _____.
3. Six factors must be considered for ARBA breed standards: shape, wool, fur, _____, _____, and _____.
4. The _____ registers and sanctions rabbit shows, breeds, and organizations throughout the United State.
5. The practice of animals eating their own fecal matter is termed _____.

Short Answer

1. What is kindling?
2. What is a buck? What is a doe?
3. How much do Flemish Giant rabbits weigh?
4. Why are rabbits used in research?
5. What research utilizing rabbits is critical to humans? Why?



CHAPTER 35

Large Game Animals



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe the general characteristics of bison, deer, and elk.
- Describe the characteristics of the bison, deer, and elk industry.
- Discuss the management of bison, deer, and elk.
- Compare and contrast the production of large game animals with traditional livestock.



KEY TERMS

novelty
beefalo
venison

introduced
species
velvet

Chronic Wasting
Disease (CWD)

LANGUAGE CONNECTION

English	French	German	Latin	Spanish
Bison	Bison	Bison	N/A	El Bizonte
Deer	Cerf	Hirsch	Cervus	El Ciervo
Elk	Wapiti	Elch	Alces	El Alce
Emu	Émeu	Emu	N/A	El Emú
Cattle	Bovins	Vieh	Pecus	Ganado
Bull	Taureau	Stier	Taurus	El Toro

Introduction to Large Game Animals

The large game animal industry has been increasing in popularity. These animals include bison, deer, elk, and antelope. One reason the industry is increasing is the concern over fat and cholesterol in the American diet. Most large game animal meat is lower in fat and cholesterol than beef and pork. Large game animals are popular with those who want to hunt the animals for sport. Exotic game ranches are popular destinations for hunters.

Bison

The American bison is genetically related to cattle, goats, and sheep. Bison belong to the Bovidae family (see Chapter 1, Table 1-1). The term “buffalo” is often incorrectly used in reference to the American bison. Buffalo, such as the Cape and Water buffalo found in Asia and Africa, are generally not found in the United States. The Asian and African water buffalo are also both from the Bovidae family, but American bison are more closely related to cattle than these buffalo.

Description Bison are large, hardy animals. Like cattle, their hair coat thickens in the winter, protecting the bison from cold weather. At maturity, bulls may weigh up to 2,000 pounds (907 kg), about the



Geography Connection

It is believed that the bison migrated to North America along with the first humans, by crossing the Bering Strait land bridge. The Bering Strait land bridge originally connected Alaska and Siberia. The bridge emerged thousands of years ago during the Paleolithic Age, also known as the Ice Age. This land appeared because the sea level dropped, due to sea water becoming concentrated in the ice caps of the North and South poles. Many believe it was during this time that humans first traveled to and settled in the Americas from Asia. As the Ice Age came to an end, the ice caps at the poles melted and shrunk in size and the land bridge eventually became covered with water—the sea once again separating America from Asia.



Science Connection

It is estimated that 60 million bison roamed America's prairie land when Columbus arrived in the New World in 1492. In the 1800s, bison were hunted almost to extinction. By 1900, no more than three hundred were left after herds were harvested for meat, hides, and sport. Today, the bison population is back up to about half a million. However, there is a problem with the heritage of the modern day bison. Bison sometimes interbred with domestic cattle on the range, and sometimes were intentionally interbred by enterprising ranchers. The first intentional cross occurred in the mid-1800s. DNA testing has shown that most bison carry some cattle genes, which puts the animal at risk. Although they look like bison, their DNA is not purely bison. Crossbreeding could have long-term effects on their ability to withstand cold or hot temperatures, fitness, fertility, disease resistance, and behavior.

There is hope for purebred bison. Two small herds, which have never been crossed with cattle, are left in Yellowstone National Park and Wind Cave National Park in South Dakota. There is also a wild herd in Alberta, Canada. Researchers are using these animals to reestablish the original wild bison.

same weight as bulls of the larger breeds of domestic cattle (Figure 35-1). When measured to the hump, bison bulls stand about 6.5 feet high (2 m) taller than most bulls of domestic cattle.



PhotoLink/Photodisc/Getty Images

FIGURE 35-1

Bison are popular game animals.

novelty

something new and unusual

beefalo

an animal that is a cross between bison and domestic cattle

Bison Terminology

Family	=	Bovidae
Group	=	Herd
Male	=	Bull
Female	=	Cow
Newborn	=	Calf

The Bison Industry The bison industry in the United States is small but growing. Bison are raised for both meat and **novelty**. Herds range from a few head to thousands. Like cattle, the most inexpensive way to feed bison is pasture grazing. Depending on the quality and quantity of the pasture, one or more acres are needed for each animal.

The **beefalo** is a cross between bison and domestic cattle (Figure 35-2). Beefalo is generally considered a beef cattle breed. Bison and cattle have been intentionally crossbred since the mid-1800s to help cattle live in cold climates, improve foraging skills, and survive for long periods without food. The first bison and cattle crosses were called “Cattalo.” However, as with mules, male cattalos were almost



Courtesy of the American Beefalo Association

FIGURE 35-2

Beefalo are a cross between bison and domestic cattle.

always sterile. In 1965, a fertile hybrid bull was produced. This fertile hybrid strain was marketed as “beefalo” in order to differentiate beefalo from cattalo and their breeding problems.

Bison meat is high in protein and low in fat, calories, and cholesterol. Bison is in fact lower in calories, fat and cholesterol than chicken. As the nutritional characteristics of bison meat become better known, the demand for the meat is expected to increase. To improve the flavor and texture of bison meat, the animals should be fed grain for the last 90 to 120 days before harvest. This helps to put finish on the bison and results in the meat tasting more like beef.

Management Bison require different handling procedures than cattle. Bison are basically wild animals. They are big animals, have great strength, and are unpredictable. To avoid serious injury, extra caution should always be used with bison. Bison can be much more excitable than cattle. Because bison are more aggressive during breeding season, working with the animals during this time should be avoided.

Bison begin breeding at about two years of age. Bison cows have a gestation period of 275 days. Breeding occurs in the summer and calving begins in the spring.

Most bison producers use ear tags as a method of identification instead of branding. Branding reduces the value of the hides. Bison hides are warm and durable, and are a valuable by-product of bison production. They can be made into coats, hats, robes, rugs, bedspreads, wall hangings, and other items. Products made from bison hides command a high price.

Bison are horned animals. If extensive handling is required, such as with herds kept for meat, owners should consider dehorning their bison. Dehorned animals are less dangerous. Other benefits of dehorning include less damage to meat and hides and smaller space requirements in feedlots and feed bunks. Owners who keep bison as an attraction or novelty like to maintain the natural appearance and usually do not dehorn their animals.

The North American Bison Registry maintains bison genetics and registers individual animals. Blood typing is used to identify individual animals, and to determine parentage and whether the animal is purebred or crossbred. Blood typing is a good management tool for selecting breeding stock, especially herd bulls.

Feeding and Nutrition The nutrient and mineral requirements of bison are similar to those of cattle. A variety of grasslands will meet the nutritional requirements of bison (Figure 35-3). Many bison, especially those kept for attraction, may be allowed to range freely. Like other ruminants, it is much cheaper to allow bison to graze rather than feed grains, hay, or other harvested crops. Supplemental feeding may be required in the winter when pasture is limited.

Because consumers who purchase bison generally want low-fat red meat, bison raised for this market are fed grass. They spend little or no time finishing in the feed lot. However, some consumers want meat from feedlot animals finished on grain because grain-finished animals have been noted to have more flavorful meat that is more tender and juicy than grass-fed bison.

If finished in a feed lot, bison are fed a finishing ration until they weigh 1,000–1,100 pounds (453–499 kg), at which point they are harvested. High-energy feeds such as corn are provided.



PhotoLink/Photodisc/Getty Images

FIGURE 35-3

Bison commonly range on grasslands.

Herd Health Bison are subject to many of the same health problems that affect cattle, sheep, and goats. See the sections on animal health for cattle, sheep, and goats for more information on diseases and parasites. As with all livestock, a complete vaccination and worming schedule should be used to protect the herd.

Facilities and Equipment Fences surrounding the pasture should be strong and at least six feet high to keep bison confined. Bison will not only break through almost any kind of fence, but will also jump fences. Woven wire fences, high-tensile wire fences, pipe and cable fences, and electric fences are most effective; however, barbed wire fences are cheaper and may be used. Cattle guards used with bison should be wider than standard cattle guards. Bison will jump regular cattle guards. As with most animals, bison that are well-maintained and fed properly will be content to stay within a fenced area.

Because bison are probably going to cause neighbors and passersby to stop and look, make sure that fences not only keep the bison in but on-lookers out. Bison can be aggressive at any time and are unpredictable. Only experienced producers should enter a pasture with bison.

Handling Facilities Bison are large and strong and tend to become excited in confined areas. Handling facilities and equipment must be made of heavy-duty materials, much more so than facilities used for cattle. The squeeze chute is used to hold the animal still for work such as testing, vaccination, and administering medications. The squeeze chute provides extra confinement by providing a head gate and an area to squeeze the animal's sides between the two pieces of metal or wood, further confining and maintaining control of the animal.

Marketing Bison producers market their bison to other breeders, exotic game ranches and meat processors. Some higher-end restaurants serve bison meat. The novelty of bison meat sometimes causes it

to bring a premium price. By-products such as hides, horns, and skulls are also marketable.

Deer

Deer farming in the United States is small compared to other livestock enterprises, and labor requirements are minimal. Several species of deer are used in the production of venison for commercial production. Some of the species include red deer, fallow deer, whitetail deer, and elk, although other species are gaining in popularity. Deer have a high feed conversion ratio, and produce a carcass with a high percentage of lean meat. Deer also have a small acreage requirement per animal and use marginal pastures unsuited for other uses.

Deer Terminology

Family	=	Cervidae
Group	=	Herd
Male	=	Buck
Female	=	Doe
Newborn	=	Fawn

Deer have several additional advantages including high fertility rates, long, productive breeding lives, easy calving, early weaning, a calm demeanor, a compact size, and low susceptibility to disease and temperature fluctuations. Captive deer are also raised for private hunting.

Deer are produced mostly for **venison** (deer meat) but are also used for their by-products, such as hides, tails, antlers, and velvet. The market for venison is small but growing in the United States. Commercially grown venison can be sold to the general public and served in restaurants.

venison
deer meat



Science Connection

The antlers of deer and elk are among the fastest growing tissues known to man, surpassed only by certain cancer cells. Male deer and elk shed their antlers each spring but quickly regenerate a larger rack, given adequate nutrition and health. Antlers may grow $\frac{1}{2}$ inch or more per day depending on the species.

introduced species

an animal or plant species which is not native to an area, but is brought in purposely or accidentally

Fallow Deer Fallow deer are a species of deer native to the Mediterranean region and Asia Minor (Figure 35-4). Fallow deer is an **introduced species** to the United States. Doe venison is the best fallow deer meat. Both does and yearling bucks are harvested when they weigh around 100 pounds. Fallow deer can reproduce at around 16 months of age. One buck can breed up to 35 females. Fawning begins in June for fallow deer.

Red Deer The red deer is one of the largest deer species (Figure 35-5). Red deer are harvested at 14 months or older when they weigh approximately



©Stockphoto/Damian Kuzdak

FIGURE 35-5

Red deer are one of the largest of the deer species.



©Stock/Benjamin Jessop

FIGURE 35-4

Fallow deer are raised for venison.

200 pounds. The breeding season for red deer lasts from early September to December. Does become sexually mature at about 16 months of age. Stags don't mature until 24 to 30 months of age. They can continue to be used for breeding until about 8 years of age. Calving begins in late May in most areas.

Elk American elk are members of the deer family (Figure 35-6). Elk are primarily raised for velvet, but are also bred for meat and by-products. Elk meat is called venison. **Velvet** is the fuzzy covering of skin over the antlers of elk and deer that supplies oxygen and nutrients to the antlers while they grow. When the antlers are full-sized, the velvet falls off and the antlers become hard, similar to bones. These are the mature antlers, which are shed yearly after the mating season. A mature elk produces about 20 pounds of velvet annually. Elk velvet is a key ingredient in Asian holistic medicine.

velvet

the fuzzy covering of skin over the antlers of elk and deer that supplies oxygen and nutrients to the antlers while they grow



Environmental Connection

Male deer and elk shed their antlers in the early spring each year, but shed antlers are rarely found. Antlers are full of calcium and other minerals often deficient in animal diets. Shed antlers quickly become food for mice, chipmunks, squirrels, and other rodents. Shed antlers do not last long in the wild. They are quickly found and used for food by other animals. Dogs are often trained to find antler sheds for collectors. Collectors and their dogs search the fields and forest in early spring for antler sheds, before the rodents find them. Some states regulate the collection of shed antlers.



Courtesy of the Bureau of Land Management

FIGURE 35-6

Elk are members of the deer family.

The commercial elk industry is very small but steadily growing due to the increasing demand for elk products and minimal acreage requirements. The labor requirements for elk production are also minimal. Elk have a calm disposition and can tolerate cold winters and hot summers with low susceptibility to most diseases.

Elk Terminology		
Family	=	Cervidae
Group	=	Herd
Male	=	Bull
Female	=	Cow
Newborn	=	Calf

Nutrition All deer and elk are ruminants and can be raised on a number of roughage feeds. Diets consist mainly of pasture and brush. Hay, grain, vitamins, and minerals should be included in the diet during the late fall and winter. Deer and elk raised for venison will usually need to be fed grain before harvest.

Fencing and Equipment Overcrowding causes diseases and parasites to be spread easily. Adequate grazing areas should be available. Pastures should be surrounded with a fence no lower than 6.5 feet tall. Most deer can jump fences under that height.

Diseases and Parasites Deer and elk have more resistance to diseases and parasites than domesticated livestock, but they are still affected by several serious diseases and parasites. The major disease in both farmed and wild species of elk and deer is Chronic Wasting Disease.

Chronic Wasting Disease (CWD) is a serious contagious neurological disease of deer and elk. The effects are similar to those of BSE in cattle, also known as Mad Cow Disease. Deer and elk in overpopulated

Chronic Wasting Disease (CWD)
a serious contagious neurological disease of deer, elk, and moose, characterized by spongy degeneration of the brain, resulting in the loss in body weight, abnormal behavior, and death

areas seem to be more affected by this disease. CWD causes small lesions on the brain, which cause loss in body condition, abnormal behavior, and death. Humans, cattle, and other domestic livestock seem to be resistant to Chronic Wasting Disease.

Deer and elk are likely to have both intestinal and external parasites. The internal worms include roundworms, tapeworms, hookworms, and pinworms. External parasites include lice and ticks as well as many flying insects that feed on their blood. Deer and elk are hosts to ticks that carry Lyme disease. Lyme disease is a serious disease of humans caused by bacteria. The disease is transmitted to humans by tick bites.

Summary

There is a growing market in the United States for bison used for meat, breeding stock, and by-products. Bison are very large, strong, and excitable animals. They can be dangerous and should be handled with care. Requirements for maintaining bison, such as feeding, facilities, and health, are similar to the management of cattle. Most of the bison in the United States have been interbred with cattle. The beefalo is a cattle breed that has bison ancestry.

Deer and elk are becoming popular alternative animals. They are used for meat, hunting, velvet, antler, and hide production. Many types of deer are raised in the United States in deer farming operations. American elk are members of the deer family. Elk are primarily raised for their velvet but are also bred for meat, by-products, and breeding stock. Chronic Wasting Disease (CWD) is a serious disease of deer and elk.

Deer and elk have more natural resistance than domestic animals, but they are still susceptible to many parasites and diseases. Chronic Wasting Disease is among the most serious diseases of deer and elk. CWD can cause abnormal behavior, loss of body condition, and death. Deer and elk may be affected by ticks and lice. Deer ticks are known to carry Lyme disease which can be transmitted to humans through tick bites.

Quick Facts

- Large game farming is a growing and important animal industry.
- The market for bison, elk, and deer is very small compared to other livestock enterprises.
- Many people prefer the meat of bison, deer, and elk for health reasons, especially fat and cholesterol in their diet.
- The beefalo is a cross between bison and domestic cattle.
- The American bison is often incorrectly called a buffalo.
- Most bison have been crossed with cattle.
- Bison migrated to North America from Siberia.
- Equipment for working with bison must be made of a heavier duty material than that used for cattle equipment.
- Bison, elk, and deer are ruminants and are raised most economically on pasture.
- Bison are big, strong and excitable. Caution must be used at all times while near bison.
- Fences for deer, elk, and bison must be strong and high.
- Deer and elk are raised for venison, hunting, hides, velvet, and other by-products.
- Two types of deer raised in the United States are the fallow deer and the red deer.
- Chronic Wasting Disease (CWD) is a serious contagious neurological disease that affects deer and elk.
- Elk are primarily raised for their velvet but are also used for meat, by-products, and breeding stock.

Student Learning Activities

1. Visit an operation where exotic animals are being raised.
2. Ask an exotic animal producer to talk to the class.
3. Prepare and give an oral report to the class on a specific aspect of raising exotic animals.
4. Prepare and present a poster to the class on exotic animal production.
5. Use the information discussed in this chapter when planning and conducting an exotic animal Supervised Agricultural Experience (SAE) program.

Discussion Questions

1. Why are people interested in bison meat and venison for food?
2. Explain the advantages and disadvantages of dehorning bison.
3. List the markets for deer and elk.
4. What is velvet and how is it collected?
5. Discuss Chronic Wasting Disease (CWD).

Review Questions

True/False

1. The American bison is not the same animal as the buffalo.
2. There is growing interest in raising bison.
3. The nutrition requirements of bison are not similar to those of cattle.
4. A beefalo is a cross between bison and domestic cattle.
5. Venison is the meat of the American bison.

Multiple Choice

1. What is the average weight of a bison harvested for meat?
 - a. 500 pounds
 - b. 1000 pounds
 - c. 200 pounds
 - d. 750 pounds
2. Chronic Wasting Disease (CWD) can cause which of the following problems in deer and elk?
 - a. lesions on the brain
 - b. behavior abnormalities
 - c. death
 - d. all of the above
3. Ranches that produce exotic animals for hunting have become popular in the _____ United States.
 - a. southeast
 - b. northeast
 - c. northwest
 - d. southwest

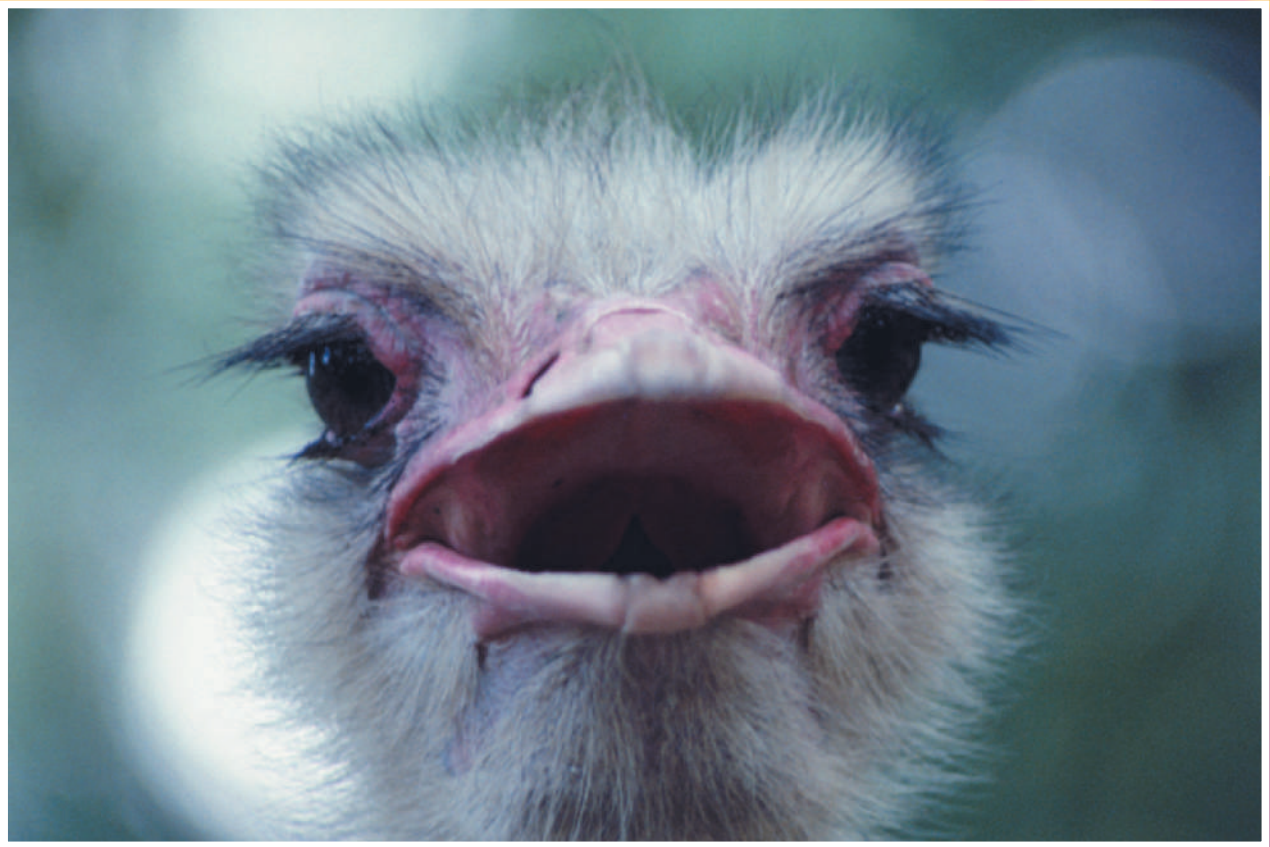
4. Deer and elk require a fence height of at least _____.
 - a. 4.5 feet
 - b. 6.5 feet
 - c. 10 feet
 - d. 3 feet
5. American bison have a _____ gestation period.
 - a. 365 day
 - b. 60 day
 - c. 275 day
 - d. 200 day

Completion

1. Deer, elk, and bison are herbivores and _____, which means they can be raised on roughages.
2. The beefalo is a cross between _____ and any domestic cattle breed.
3. The two kinds of external parasites most often found on deer and elk are _____ and _____.
4. Another name for deer or elk meat is _____.
5. The cattalo was an early cross between a bison and a cow, which resulted in _____ offspring.

Short Answer

1. Describe the major differences between red deer and fallow deer.
2. Bison belong to what family?
3. What are the advantages of having a deer farming operation?
4. Describe the specialized equipment needed to handle bison.
5. What group maintains bison genetics and registers individual animals?



CHAPTER 36

Ratites



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Describe the differences between ostriches, emus, and rheas.
- Discuss management practices for ratites.
- Explain the safe handling of ratites.
- Discuss the marketing of ratites and their products.



KEY TERMS

ratite
ostrich

biped
monogamous

polygamous

LANGUAGE CONNECTION

English	French	German	Latin	Spanish
Emu	Émeu	Emu	N/A	El Emú
Egg	Œuf	Ei	Ovum	El Huevo
Feather	Plume	Feder	Pluma	La Pluma
Hatch	Éclore	Schlüpfen	Excludere	Salir del Cascarón
Ostrich	Autruche	Strauß	N/A	El Avestruz

ratite

large flightless bird

Ratites

Ratites are large flightless birds that are capable of running at high speeds (Figure 36-1). Although ratites are unable to fly, their wings are used for balance, changing direction as the bird runs, and for defense. The ratite family includes the ostrich, emu, rhea, cassowary, and kiwi. In the United States, the ratite industry consists of ostriches, emus, and rheas, with ostriches and emus being the most important. Rheas are produced, but are a distant third. The cassowary and kiwi are not produced commercially.



PhotoLink/Photodisc/Getty Images

FIGURE 36-1

Ostriches are an example of a ratite.

Scientific Classification

Kingdom	-	Animalia
Phylum	-	Chordata
Class	-	Aves
Subclass	-	Neornithes
Superorder	-	Paleognathae
Order	-	Struthioniformes

Families:

• Ostrich	=	Struthionidae
• Emu, Cassowary	=	Casuariidae
• Rhea	=	Rheidae
• Kiwi	=	Apterygidae



Courtesy of Shannon Lawrence

FIGURE 36-2

Boots made from ostrich leather.

Products

The ratite industry in the United States is small. Ratite products include meat, leather, eggs, feathers, and other by-products such as oil and bones. The low-fat, low-cholesterol, red meat is popular in Europe and is becoming more popular in the gourmet market of the United States. Although ratites are birds, they have red meat that is more like beef than chicken.

Leather products made from ratites include clothing and accessories, such as shoes, coats, belts, boots, purses, and briefcases (Figure 36-2). Ostrich leather is flexible and durable while being soft to the touch. Full of natural oils, ostrich leather resists drying, cracking and stiffness. Emu leather is thinner and finer textured than ostrich leather.

Emu oil produced from fat is used for pharmaceutical and cosmetic purposes. Emu oil is also used as a health additive in human diets, and is considered to be a therapeutic and healing substance. Emu oil is high in Omega-3, -6 and -9 oils. One emu will produce about five to six liters (1.3–1.6 gallons) of oil. Ratite feathers are used in fashion and for feather dusters. By-products of ratites, such as eggs and toenails, are used for crafts and as decorations.

It is important to note that the business of ratite production has been highly volatile over the years. The market and distribution system for ratite meat and by-products is not well developed as compared to other agricultural industries such as swine and beef. During the best years, when interest in ratite production was high, the most profitable practices were selling breeding pairs and hatching eggs. At one time, breeding stock brought extremely high prices. When markets and consumer demand failed to develop, prices fell drastically. A person wishing to establish a ratite business should be sure they have a ready market for the meat and by-products.



History Connection

In the 1980's and 1990's Texas and Oklahoma were major importers and producers of ratites. In the early years of importation of fertile eggs and chicks, many people were enticed to spend thousands of dollars to get the best animals possible. During this time, demand far outweighed the supply, which drove the prices for the eggs and chicks to abnormally high prices. Many people misinterpreted the need for the production of emus and ostriches and lost money on these enterprises.

The market became overloaded with ratites and prices got so low that many owners just opened their gates and let the emus and ostriches roam freely. It was not unusual to see ratites free-ranging in pastures and on highway right-of-ways.

Types of Ratites

There are three different species of ratites of economic importance – ostrich, emu, and rhea. The ostrich, native to Africa, is the largest and fastest of the three. Emus are native to Australia and are smaller than the ostrich. Rheas are still smaller and are from Central America.

Ostrich

The **ostrich** is the largest bird in existence (Figure 36-3). At maturity, an ostrich can weigh 200 to 350 pounds (91–159 kg) and measure seven to nine feet (2.1–2.7 m) in height. Its stride can range from 15 to over 20 feet (4.5–6 m). The ostrich can run at speeds up to 50 miles per hour (48–80 km/h) for up to 30 minutes. It is one of the fastest land animals on Earth and easily the fastest **biped** (Table 36-1).

Contrary to popular belief, ostriches do not bury their heads in the sand. In reality, the ostrich lays its tan-colored head and neck flat on the ground to hide itself from predators. This makes the bird appear like a mound of earth from a distance. Often, the haze that is formed from the hot and dry air occurring in their natural environment aids in their



©iStockphoto/Ben Blankenburg

FIGURE 36-3

Ostriches are raised for meat and by-products.

ostrich

largest bird in existence

biped

an animal that walks on two legs

TABLE 36-1

Top Speeds of Land Animals

Cheetah	75 mph (112 km/h)
Pronghorn Antelope	61 mph (98 km/h)
Ostrich	50 mph (74 km/h)
Quarter Horse	45 mph (72 km/h)
Greyhound	45 mph (72 km/h)
Human	27 mph (44 km/h)

disguise. Ostriches have very powerful legs and can deliver a fatal blow to a predator or human if it gets too close.

While there are three different varieties of the ostrich, the African Black is the only one that has been successfully farmed. Ostriches are farmed in over 50 countries around the world. Ostriches have a very good feed conversion ratio and can make use of marginal land and land in harsh climates. African Black ostrich males and females appear different – the male is black with white on the wings, and the female is brown and white. All juveniles are brown in color to help disguise them from predators.

Ostriches will mate under either monogamous or polygamous conditions. In a **monogamous** relationship, an animal has only one mate during its breeding season or breeding life; in **polygamous** relationships, animals have more than one mate during a single breeding season.

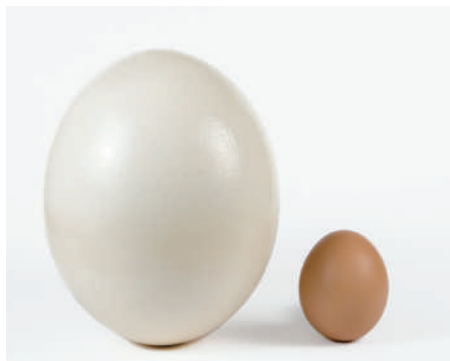
In the United States, breeding and egg laying occur between the months of March and September. On average, ostrich hens will lay about 45 eggs in one season, but can lay up to 90. Ostrich eggs are much larger than chicken eggs, weighing three to five pounds (1.4–2.3 kg). Shown in Figure 36-4 is the difference between an ostrich egg and a chicken egg. Generally, the male sits on the nest at night and the female sits on the nest during the day.

monogamous

having only one mate during the breeding season

polygamous

having more than one mate during the breeding season



©Stockphoto/Jaroslav Janczuk

FIGURE 36-4

Note the difference in size of an ostrich egg and a chicken egg.



Science Connection

In 2005, the first reported discovery of preserved dinosaur soft tissue, including blood vessels and cells, was made. Examination with an electron microscope showed the dinosaur blood vessels to be “virtually indistinguishable” from those recovered from ostrich bones. There is clearly a connection, but only time will reveal just how closely related ostriches are to dinosaurs.

did you know?

Ostrich Feathers

Undoubtedly, the paint booth in the BMW plant is the cleanest section of the entire factory. The workers in this section wear dust- and lint-free uniforms from head to toe while handling the equipment and the vehicles. The unpainted BMW auto bodies enter the spotless environment and are immediately cleaned with ostrich feathers to brush away any dust or fine particles that may ruin the paint.

Many people think nothing removes dust in the home better than an ostrich feather duster. There is much disagreement as to why ostrich feathers are so good at dusting. BMW proposes that the static charge makes ostrich feathers highly efficient at attracting dust.

Emu

The emu is the second largest bird in existence (Figure 36-5). Mature emus reach a height of five to six feet (1.5–1.8 m) and weigh about half as much as their ostrich relatives. Emus can run at speeds of up to 30 miles per hour (48 km/h).

Emus pair up in the summer months and breed in the cooler months. The male builds a nest on the ground in which the female will lay 8–10 eggs. Unlike most birds, the emu male is the one who incubates the eggs. Emu eggs are green and weigh about 1 pound (0.5 kg).

Emus are usually paired in monogamous relationships during breeding season. Females are the dominant member of emu pairs and choose their mate and nesting site. The female is very protective of her nesting site.



©Stockphoto/Steven Cooper

FIGURE 36-5

Emu.



©Stockphoto/Jim Mills

FIGURE 36-6

Rhea.

Rhea

The Rhea is similar in appearance to the ostrich, but is much smaller (Figure 36-6). Rheas are the largest native bird to the Americas and can typically be found in Brazil and Argentina. At maturity, rheas are about 4–5.5 feet (1.2–1.7 m) tall and weigh around 40–55 pounds (18.14–22.5 kg). Like the ostrich and emu, the rhea is a fast runner.

Rheas are polygamous. A group usually consists of one male and at least six females. All females in the group lay their eggs in the same nest. The male sits on the nest to incubate the eggs.

Ratite Eggs and Incubation

In the United States, ratite producers generally use artificial incubation for eggs. For ostrich eggs, the average incubation time is 42 days. The incubation period for emu eggs averages 56 days, while rhea eggs average 39 days before hatching.

After hatching, ratite chicks need to be kept warm for the first 10–20 days. Do not overcrowd the chicks in the brooding area; overcrowding can result in smothering. After 20 days, the chicks can be moved to a larger area with access to the outdoors depending on weather conditions.

Ratite Feeding

Commercial ratite starter, grower, and breeder rations in mash or pellet form are available to provide ratites with necessary nutrients. Because little research has been done on the nutritional requirements of these birds, commercial feeds are based on nutritional research done with chickens, turkeys, and game birds. Ratites will scour the land for forage and insects to feast upon, so beetles, grasshoppers, locusts and other insects are a normal part of their diet.

Handling

Mature ratites can be dangerous to handle. When nervous, ratites will jump, flail their wings and kick. Mature birds must be restrained when being examined or receiving medical treatment. This is for the protection of the people handling the animal, as well as for the animal. It is often easier to handle a ratite if an opaque hood is placed over the bird's head and eyes, as it will stand calmly when it cannot see.

Facilities

Ratites are generally raised outdoors with access to pasture. Young ratite chicks can be kept in small pens. Mature birds should have shelter from cold temperatures and inclement weather. High mesh-type fences work best to contain ratites in the pasture environment. In confined areas, high, solid walls should be used.

Health

Ratites are subject to many of the same illnesses and parasites that affect chickens, turkeys, and other poultry. The highest mortality rate occurs within the first six months of life. To reduce the risk of disease, use a good prevention program. Keep all equipment clean and disinfected.

Summary

Ratites are large, fast, flightless birds. The ratite industry in the United States includes the ostrich, emu, and rhea. Ostriches and emus are the most common. Ratites produce red meat that is low in cholesterol and fat. Ostrich hens produce 40 to 50 eggs per year; emus produce about 30 eggs yearly. The nutritional requirements of ratites are similar to those of chickens and other

poultry. Handle ratites carefully to prevent injury; mature birds can be dangerous when nervous. Ratites can deliver deadly kicks. The market for ratites is highly volatile. To date, strong consumer demand and corresponding markets for ratite meat and by-products have failed to develop.

Quick Facts

- Ratites are large flightless birds.
- The ratite family includes the ostrich, emu, rhea, cassowary, and kiwi.
- Ratites are used for meat, leather, feathers, and by-products.
- The meat of ratites is a red meat like beef.
- Emu oil is a non-toxic, anti-bacterial, anti-microbial, and anti-inflammatory moisturizer and skin softener.
- The ratite market is very small.
- Feed for ratites is based on nutritional research conducted on chickens, turkeys, and other birds.
- The ostrich is the largest bird in existence and one of the fastest animals on earth.
- Ratites can be dangerous and must be handled with care.
- Ratites have a high feed conversion ratio.
- The ratite market is highly volatile.

Student Learning Activities

1. Visit an operation where ratites are being raised, or view ratite sites online.
2. Have someone who raises ratites talk to the class.
3. Prepare and give an oral report to the class on any aspect of raising ratites.
4. Prepare and present a poster to the class on ratite production.
5. Use the information discussed in this chapter when planning and conducting a ratite Supervised Agricultural Experience (SAE) program.

Discussion Questions

1. Discuss the mating of ratites.
2. Discuss the incubation of ratite eggs.
3. Why should care be taken when handling mature ratites?
4. Describe the proper method of handling mature ratites.
5. What products are produced from ratites?

Review Questions

True/False

1. The rhea is the second largest bird in existence after the ostrich.
2. Generally, the male ostrich sits on the nest at night and the female ostrich sits on the nest during the day.
3. The highest mortality rate occurs in ratites within the first six months of life.
4. The market for ratites is stable.
5. Ostriches are native to Australia.

Multiple Choice

1. The meat of ratites is most like _____.
 - a. pork
 - b. beef
 - c. turkey
 - d. chicken
2. Overcrowding chicks in the brooding area can result in:
 - a. repression
 - b. Bovine Respiratory Disease
 - c. stifling
 - d. smothering
3. Ratites are considered _____.
 - a. monopeds
 - b. quadrupeds
 - c. bipeds
 - d. tripeds
4. Which ostrich species is used in commercial farming operations?
 - a. Little giant
 - b. African black
 - c. White broadbreast
 - d. Great capon
5. Emus are considered to be _____ breeders.
 - a. monogamous
 - b. polygamous
 - c. quadgamous
 - d. undegamous

Completion

1. Emu _____ is produced from fat and is used in cosmetic and pharmaceutical products.
2. Ratite products include meat, _____, _____, _____, and other by-products such as oil and bones.
3. Ostriches hide themselves from predators by _____.
4. The largest bird on Earth is the _____.
5. An ostrich can run up to _____ miles per hour (mph).

Short Answer

1. Describe the ostrich in terms of its height, weight, and speed.
2. When is the mating season for ostriches in the United States?
3. On what basis are ratite rations formulated?
4. If an ostrich egg weighs 5 pounds and a chicken egg weighs 2 ounces, how many chicken eggs would it take to equal one ostrich egg?
5. Describe the fencing needed for an ostrich farm.



CHAPTER 37

Game Birds



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Discuss the game bird industry.
- Identify the major game birds produced.
- Outline biosecurity measures for game bird production.
- Discuss the diet, health, and marketing of game birds.



KEY TERMS

game birds
gallinaceous

indigenous
incubate

biosecurity
cannibalism

LANGUAGE CONNECTION

English	French	German	Latin	Spanish
Quail	Caille	Wachtel	Coturnix	La Codorniz
Feather	Plume	Feder	Pluma	La Pluma
Flock	Troupeau	Herde	Grex	El Rebaño
Egg	Œuf	Ei	Ovum	El Huevo

game birds

birds, such as quail, duck, and pheasant that are hunted for sport



Courtesy of Whitney Kizer

FIGURE 37-1

Game birds are hunted for sport.

Game Birds

Game birds are birds, such as quail, duck, and pheasant that are hunted for sport (Figure 37-1). Many of these species have been domesticated or semi-domesticated and are produced in captivity. The game bird production industry is small compared to other animal enterprises. Markets are not well-developed or readily available in some areas. However, game bird production is an important source of income for many producers.

Many species of game birds are produced specifically for hunting or restocking wild populations. Game bird hunting is a popular sport. Individuals, hunting clubs, and other organizations often purchase birds raised in captivity for release on private game ranches and hunting farms. Game birds are also raised in captivity for the gourmet and specialty meat market. However, most are raised for hunting purposes.

Although game birds are sometimes quite small, their meat is prized by many people. The meat of wild birds has a more gamey flavor and stronger taste when compared to game birds raised in captivity. The milder taste and consistent flavor of game birds raised in captivity is due to controlled conditions and a managed diet.

Bird Terminology

Some interesting old and new names to describe a group of birds of a particular species:

- A bouquet of pheasant [when flushed] (Flushed means for the group of birds to become scared and take flight.)
- A gaggle of geese [wild or domesticated]
- A rafter of turkeys
- A covey of quail
- A murder of crows

gallinaceous

heavy bodied, ground-feeding birds that generally fly only short distances

indigenous

originating in a particular area

Quail

Quail are **gallinaceous** birds (Figure 37-2). Gallinaceous birds are those that can only fly short distances and feed on the ground. Quail are closely related to turkeys and chickens. The best known quail in the United States is the bobwhite quail. The bobwhite quail is **indigenous**, or native, to the United States. The most popular of the bobwhites is the Eastern Bobwhite; other bobwhite species include the Plains, Masked, Texas, and Florida Bobwhites. The bobwhite quail weighs six to eight ounces. It is brown with blended yellow and black upper parts.



©Stockphoto/Bryan Eastham

FIGURE 37-2

Bobwhite quail.



Science Connection

The bobwhite got its name from the call it makes. The call sounds as if the bird is saying “Bob, Bob, White.”

Coturnix quail, also known as Japanese quail, were imported into the United States from Japan. They have been domesticated in Japan for many centuries. They should not be confused with the bobwhite or other native quail. Breeds include the Manchurian Golden, British Range, English White, and

Tuxedo. Coturnix quail are used mostly in the food industry, while bobwhite quail are in high demand for hunting.



Science Connection

Did you know that a quail's parental instinct is so strong that they will sacrifice themselves for their young? Quail, and some other birds, will fake having a broken wing and make themselves appear to be an easy catch to lure a predator away from the nesting site. After they have lured the predator away, they will fly away from the predator, and hopefully, return safely to the nest.



Culinary Connection

Quail eggs are a staple in the pantry of many top restaurants. The slightly gamey taste appeals to chefs who wish to present unique flavors. The small size is perfect for a small mouthful of a tantalizing dish.

Partridges

Partridges are closely related to quail. There are two species used for production in the United States- the chukar and the Hungarian partridge. The chukar partridge, commonly referred to as the red-legged or rock partridge, has been in the United States since the 1930s. The chukar partridge is native to the Middle East and Asia. Chukars are gray-bodied with orange or red legs (Figure 37-3). It has a thick black line running across their forehead, through their eyes, and down their neck. Chukars weigh around 19 to 24 ounces, with males being larger than females in length and in weight.

The Hungarian partridge, native to Hungary, is more commonly known as the gray or Hun partridge. Huns have brown and gray body feathers and gray chests, and their wings are short and round. Hungarian partridges weigh about one pound (16 ounces). Partridge meat is used as a gourmet item in high-end restaurants, as well as for hunting and wildlife restocking.



©Stockphoto/Frank Leung

FIGURE 37-3

Chukar partridge.



©Stockphoto/Stephen Muskie

FIGURE 37-4

Chinese ring-necked pheasant.

Pheasant

Pheasant are gallinaceous birds. Like partridges, pheasant are originally from Asia. They have been widely introduced around the world, including the United States, as a game bird. Varieties of the pheasant include the Japanese, Chinese ring-necked, Mongolian, and the English pheasant. The Chinese ring-necked male is the species most recognized by Americans because of its colorful feathers (Figure 37-4).

Male pheasant (cocks) are much larger than females and tend to have brighter colors. Physical traits of the Chinese ring-necked cock include a green head, red eye patch, white ring around the neck and brown feathers below the neck. Female Chinese ring-necked pheasant have brown feathers on their heads and bodies. All pheasant have long tails, accounting for up to half of the total length of the bird. Pheasant are used for meat in restaurants, specialty markets, and hunting and wildlife restocking programs.



Geography Connection

The ring-necked pheasant is the state bird of South Dakota, but the bird is actually native to Asia.

Ducks

Ducks are raised for meat and for release for hunting. Mallards and wood ducks are the breeds raised for hunting. Many are raised on farms for home consumption and local sales.

The most popular wild breed used in commercial production is the mallard duck, the most common duck of the Northern hemisphere (Figure 37-5). Mallard ducks are popular game birds (water fowl) on hunting preserves. The mallard male has a distinctive green head that is treasured as a trophy. Mallard duck meat is becoming more available on restaurant menus.



Courtesy of Amanda Stephens

FIGURE 37-5

Mallard ducks. Male (L) and female (R).

Raising Game Birds

As with any livestock, management of game birds is essential to a successful enterprise. In game bird management and production, it is much easier and cheaper to prevent problems than to solve them. Beginning producers should start with a small flock and increase the flock size as experience is gained.

Before obtaining the eggs or chicks, it is important to research laws governing the production of game birds. Most states have laws and regulations governing the raising of indigenous species, especially concerning the release of non-native species into the wild. Check with the local conservation office or the state wildlife office for the laws and regulations covering the use of game birds.

The best way to establish a flock is by purchasing hatching eggs or day-old chicks, because mature birds are more likely to transmit disease and parasites. The eggs or chicks should be purchased from a reputable breeder who participates in The National Poultry Improvement Plan (NPIP), a program that strives for disease-free poultry.

In commercial production, eggs are hatched in an **incubator** instead of by the mother bird. Hatching time varies, but is generally 23 days for bobwhite quail, 24 days for pheasant, and 28 days for ducks.

A brooder house for chicks is essential when producing game birds. Young birds cannot regulate their body temperature well. Chicks must not be allowed to become chilled. Brooders are used to provide supplementary heat for game bird chicks as well as other bird species.

There are several types of housing for game birds. Each type has advantages and disadvantages. Housing types include floor pens, colony cages, and individual cages. Floor pens are the most economical, but eggs can become dirty, increasing the chance of disease transmission. Colony cage systems are cages usually raised off the floor with wire bottoms. They may house several females and a male. The advantages include

incubate

to sit upon (eggs) or use artificial heat for the purpose of hatching

did you know?

It is illegal in most states to release game birds raised in captivity into the wild. Reasons include a negative effect on the gene pool of the wild population, and the possibility that released birds could spread new diseases to wild birds. In addition, there is very little chance of survival of released birds that were raised in captivity.

biosecurity

protecting living things from biological harm, such as diseases, pests, and bioterrorism

clean eggs, while the disadvantages include not being able to identify and cull unproductive females. Individual cages are the most expensive because they only contain one breeding pair. The advantage is being able to cull unproductive birds, and having clean eggs. The disadvantages include a more expensive cage system and more room needed to house the pairs.

Birds being produced for hunting or restocking of a wild population need a flight pen. These birds must learn to fly to survive and should have as little contact with humans as possible during production. Their ability to fly and their fear of humans will be essential to their survival when released. Flight pens are covered with a mesh top and have sides usually made of chicken wire. Flight pens must be wide and long enough to allow the birds room to fly about and exercise their wings.

Diet

Quail, partridge, and pheasant have diets very similar to other types of poultry. Commercially prepared feeds for game birds usually provide a complete and balanced ration. Choose feeds with high levels of protein. Specific dietary needs vary, depending on the intended use of the stock. As with chickens, if soft-shelled eggs become a problem, a calcium source should be added to the feed. Fresh, clean water should be available at all times.

Health

Biosecurity is important in game bird production. Diseases are easily introduced and some can spread quickly, devastating a flock. New stock should be purchased from a reputable producer. Once the flock is established, it is highly recommended that no outside adult birds come into the flock to prevent transmission of disease (Figure 37-6). All new birds should be hatched from eggs or purchased as day-old chicks. If new adult birds are purchased, they should be quarantined for approximately three weeks.



©iStockphoto/Olga Utiyakova

FIGURE 37-6

It is generally recommended not to introduce outside adult birds into the flock.

cannibalism

the practice of an animal feeding on the flesh of its own kind

Another biosecurity precaution is keeping foot traffic to a minimum. Most diseases of game birds raised in confinement are spread by the bird caretaker, not the birds. Workers should not be allowed to own other birds outside the flock they are handling. Disinfectant foot baths at doors can help reduce transmission of pathogens from contaminated areas. Only people caring for the birds should come in contact with them. Do not use equipment from other bird owners unless it has been thoroughly cleaned and disinfected. It is also important to keep buildings and equipment clean.

Beak Trimming

Beak trimming of game birds is a common practice in confinement. This helps to cut down on **cannibalism**. Cannibalism is a common problem with birds in confinement. A number of conditions that cause stress contribute to cannibalism, including overcrowding, overheating, and nutritional deficiencies.

Disease

Game birds are affected by some of the same diseases as poultry. These include coccidiosis and avian influenza. Treatment for game bird diseases is usually similar to that of chickens and turkeys, with good sanitation and management practices for prevention being key. However, game birds are more susceptible to poor management and sanitation practices than domestic fowl. Fast removal and disposal of all sick birds, with proper sanitation, are essential practices for disease control. This includes burying or burning the affected dead birds. Check with local or state officials for information about proper sanitation and disposal methods.

Game birds are capable of spreading diseases to other poultry as well as to livestock and humans. Some of these diseases are zoonotic, which means the disease can be transmitted from animals to humans, or, more specifically, a disease that normally exists in animals but can infect humans. A familiar

zoonotic disease of birds is avian flu, better known as bird flu. On the whole, there are only a small number of bird diseases that can be spread to humans as compared to mammalian diseases.

Ulcerative Enteritis Ulcerative enteritis is a bacterial infection in quail, but may affect other game birds as well as chickens and turkeys. In quail, this disease is highly contagious and can result in 100% mortality in just 2–3 days.

Parasites

Game birds kept in confinement are more susceptible to both external and internal parasites because of the number of birds in close proximity to each other. This gives the parasites a number of hosts on which to feed. External parasites include fleas, lice, mites, ticks, and mosquitoes. Many of these, including mosquitoes, can also transmit diseases. Internal parasites include large roundworms, cecal worms, cappillarid worms and tapeworms. Cecal worms infect the lining of the ceca and are not considered a problem parasite. The cappillarid worm is a problem parasite with potentially lethal consequences. The cappillarid worm lives in the tissue layers around the ceca and can cause the stomach lining to swell, causing the bird to starve to death.

Toxins

Game birds are very sensitive to toxins from contaminated feedstuffs. Moldy feeds can contain deadly toxins. All spoiled, moldy, or wet feed should be disposed of properly.



Science Connection

Birds that are cold will puff up their feathers, trapping air between the feathers and the skin to form an insulating layer of air. This process is similar to humans getting goose bumps. If humans had more hair, the goose bumps would raise the hair, trapping an insulating layer of air.

Marketing

There are several viable markets for game birds. The most popular market is for hunting and game preserves. Game birds, usually quail and pheasant, are purchased by preserves at around fifteen weeks of age for release.

Since the birds will need to fly very soon after release, it is important to train the birds in flight pens. Buyers want birds to be healthy, have good coloring, be of good size, and have a complete coat of feathers. The objective is for the birds to adjust to the natural habitat and be indistinguishable from native birds. The higher quality the birds, the more money the breeder can expect to receive.

Secondary markets for game birds include meat and egg production. The meat of game birds is often marketed for use in gourmet establishments. The larger breeds of coturnix (Japanese) quail are usually used in the production of quail for meat. They grow more efficiently and produce larger, meatier carcasses than bobwhite quail. Partridge and pheasant are both used in the food industry for the gourmet market. In addition, game birds are used by private individuals for custom harvesting and home use.

Summary

Game birds are raised in the United States for hunting, meat, and eggs. Some states have restrictions against releasing domestic birds into the wild. Some of the most popular game birds are the bobwhite and Coturnix quail, pheasant, ducks, and partridge. Game birds have a diet similar to that of chickens and turkeys. A brooder to provide supplemental heat for chicks is essential. It is extremely important to keep buildings and equipment clean, and use proper biosecurity procedures to prevent and control the spread of disease. The major use of game birds raised in captivity is for stocking hunting preserves. If birds are to be released for hunting, it is important that birds be healthy, be trained to fly, and have a fear of humans. When released into the wild, birds should be indistinguishable from native birds.

Quick Facts

- Game birds are species of birds hunted for sport.
- Game birds are produced in captivity for meat, eggs, and to be released for hunting.
- The bobwhite quail is indigenous, or native, to the United States.
- The bobwhite quail weighs six to eight ounces and is brown with blended yellow and black upper parts.
- Partridges are closely related to quail.
- The two major breeds of partridge raised are the chukar and the Hungarian.
- The chukar partridge is native to the Middle East and Asia.
- The Hungarian partridge, native to Hungary, is more commonly known as the gray or Hun partridge.
- Male ring-necked pheasant are more brightly colored than females.
- Mallard and wood ducks are raised and released for hunting and for meat.
- Mallard duck males have a bright green head.
- There are three types of housing used in confinement production: floor pens, colony cages, and individual cages.
- The main use of game birds raised in captivity is for hunting, but many are used in the specialty and gourmet food industries.
- The mixing of adult birds, especially birds from outside sources, with young birds should be avoided to minimize disease transmission.
- It is very important to maintain biosecurity and sanitary facilities in game bird production.
- Game birds raised to be released for hunting must be healthy, be trained to fly, and have a general fear of humans to blend in with native birds.

Student Learning Activities

1. Have someone who raises game birds or a representative from a group such as Quail Unlimited and Ducks Unlimited, come and talk to the class.
2. Prepare and give an oral report to the class on a species of game bird raised for meat, eggs, or hunting.
3. Prepare and present a poster to the class on game bird production. Additional research can be obtained from web sites.

4. Visit a game bird ranch or view videos on the internet about game bird production.
5. Using this chapter and sources from the internet, design a confinement system for raising game birds.

Discussion Questions

1. Discuss three breeds of game birds raised in the United States.
2. List and explain equipment needed for game bird production.
3. Describe the basic diets for game birds.
4. What are some steps that can be taken to avoid health problems within the flock?
5. Discuss the markets for game birds.

Review Questions

True/False

1. When borrowing equipment from other flock owners, the equipment must be disinfected first before use.
2. The market for game birds is small.
3. Game birds carry some of the same diseases that also affect poultry.
4. When starting a flock, producers should purchase mature birds.
5. Game birds are not capable of spreading disease to other poultry, livestock, and humans.

Multiple Choice

1. Male ring-necked pheasant tend to be _____ than the females.
 - a. larger
 - b. brighter in Color
 - c. None of the above
 - d. a and b
2. The bobwhite quail is native to what country?
 - a. Asia
 - b. Germany
 - c. Netherlands
 - d. United States

3. The most popular wild breed used in commercial production is the _____ duck.
 - a. mallard
 - b. wood
 - c. white Pekin
 - d. none of the above
4. Game bird diets are similar to the diets of _____.
 - a. domestic poultry
 - b. swine
 - c. cattle
 - d. sheep
5. Biosecurity measures include _____.
 - a. disinfectant foot baths
 - b. spraying
 - c. workers wearing masks
 - d. chemical suits

Completion

1. The _____ is a breed of quail used mostly in the food industry, and was imported into the United States from Japan.
2. Game birds are raised in the U.S. for _____, _____, and _____.
3. The three types of confinement housing are _____, _____, and _____.
4. Game birds are _____ susceptible to disease when in confinement.
5. Beak trimming cuts down on _____, which is a common problem among birds in confinement.

Short Answer

1. Name three of the birds mentioned in this chapter.
2. Feed that is high in what should be used to feed birds?
3. What essential thing is needed in a brooder house?
4. What are gallinaceous birds?
5. Name five external parasites and four internal parasites that can affect game birds.



CHAPTER 38

Llamas and Alpacas



OBJECTIVES

Upon completion of this chapter, the student should be able to:

- Discuss the history of llamas and alpacas.
- Describe the characteristics of llamas and alpacas.
- Discuss the feeding and management of llamas and alpacas.
- Explain income sources from llama and alpaca production.



KEY TERMS

closed registry
cria

modified
ruminant

kush
berserk male
syndrome

LANGUAGE CONNECTION

English	French	German	Italian	Spanish
Alpaca	Alpaga	Alpaka	Alpaca	La Alpaca
Colostrum	Colostrum	Kolostrum	Colostro	El Colostro
Llama	Lama	Lama	Lama	La Llama
Ruminant	Ruminant	Wiederkäuer	Ruminante	El Rumiante

Llamas and Alpacas

Llamas and alpacas are related to camels and are members of the Camelidae family. They are used for breeding stock, fiber production, and as pets. Llamas are also used as pack animals and as guard animals for other livestock. Alpacas and llamas are used for meat in South America.



Geography Connection

Llamas appear to have originated from the central plains of North America about 40 million years ago. They migrated to South America around 2.5 million years ago. Llamas and alpacas are native to the Andes of Ecuador, Peru, Bolivia, and Chile. Llamas were domesticated about 5,000–6,000 years ago and are among the world's oldest domestic animals. They were widely used as pack animals by the Incas and other natives of the Andes Mountains because they are well-adapted to high altitudes, and can tolerate temperature extremes of hot days and cold nights, as well as constant drought.

Llama and Alpaca Terminology

	Alpaca	Llama
Baby	Cria	Cria
Female	Hembra	Female
Castrated Male	Macho	Gelding
Female Parent	Dam	Dam
Male Parent	Sire	Sire

closed registry

a registry that does not accept animal offspring unless both parents have been registered

The International Llama Registry (ILR) maintains and tracks genealogy records of llamas and alpacas for owners and breeders. The ILR is a **closed registry**,

cria

baby llama or alpaca

meaning both parents must be registered before llama offspring, called **cria**, can be registered. There are roughly 200,000 llamas in the United States, ten times as many as their close relative, the alpaca. They were first imported to the United States in the late 1800s.

The Alpaca Owners and Breeders Association (AOBA) maintain the Alpaca Breed Registry. Alpacas must be blood-typed in order to be registered. There are approximately 20,000 alpacas in the United States, and virtually every one is registered. Importation of alpacas from South America has been closed since 1996, due to import restrictions. Alpacas were not imported until 1983.

Characteristics

Llamas and alpacas have two-toed feet with a broad pad on the bottom, allowing them to walk on a variety of terrain. They have great agility and surefootedness, allowing them to walk over rough and steep terrain. Their upper lip is split, making it easier to grasp forage when grazing. Both llamas and alpacas can carry up to 30% of their weight in packs, which makes them a stronger pack animal than the horse. However, because alpacas are small animals, llamas are most often used as pack animals since they are larger and can carry more weight. On average, llamas and alpacas have a life span of 20–25 years.

Mature llamas weigh approximately 280–450 pounds (127–204 kg) and stand about four feet high (1.2 m) at the shoulders (Figure 38-1). Llamas have long necks and stand 5.5–6 feet (1.7–1.8 m) tall at the head. Their coat colors include white, black, brown, grey, and red. Patterns of the wool coat can vary from solid to spotted.



History Connection

Llamas and alpacas have been important to the Incas and other cultures of the Andean Mountains for thousands of years. Tiny figurines of llamas were often buried with the Inca dead. It was thought that these items were offerings to the gods. Llamas were vital for transportation, meat, and wool for clothing. Alpaca fiber was reserved for Inca royalty.



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FIGURE 38-1

Llama.



© iStockphoto/Mike Dabell

FIGURE 38-2

Alpacas.

Alpacas are smaller than llamas in weight and height. They weigh 120–180 pounds (45–75 kg). Alpacas stand approximately three feet (0.9 meters) at the shoulder (Figure 38-2). Like llamas, alpacas also have long necks, and stand at about 4.5 feet (1.4 meters) at the head. There are 22 distinct natural colors of fur, ranging from shades of white and black to brown and red. Alpacas tend to have a more uniform (solid) coat color while llamas often have a mixed colored coat.



Delmar/Cengage Learning

FIGURE 38-3

Many clothing items and other products are made from llama and alpaca fiber. The fibers are lighter and warmer than sheep wool.

modified ruminant

an animal with a three-compartment stomach; not a true ruminant, which has a four-compartment stomach

There are two types of alpacas – the Huacaya and the Suri. The differences in the two types are not noticeable to most people, but are important to breeders and producers of fiber. Basically, the Suris have a flat hair coat and the Huacayas have a coat that is more “wooly.”

Fiber Production

Llama and alpaca producers have two sources of income, fiber and live sales. The fiber is considered by some to be far superior to the wool of sheep (Figure 38-3). The fiber of llamas and alpacas is lighter and warmer than wool. Like sheep, llamas and alpacas are shorn annually.

Most producers of llama and alpaca fiber are members of co-operatives. These co-operatives are run by the members of the organization, and help to provide a market for the fiber produced. This helps the small producer and also the larger producer because the same price is obtained for all the fiber produced.

Feeding

Llamas and alpacas are **modified ruminants**, meaning their stomachs have three compartments. The stomachs of other ruminants have four compartments, but both function in the same manner. Both llamas and alpacas will graze pasture grasses, and can be kept on marginal pasture land unsuitable for farming. Their feeding habits are similar to that of sheep. They are easy keepers, which means that little to no grain is required for them to remain fit.

Hay is the predominant feed used for llamas and alpacas when pasture is not available. Good-quality forage can replace grain supplementation for animals unless they are pregnant or working pack animals, which demand higher nutritional needs. It is important to provide necessary nutrients for the animal in the form of trace-mineralized salt and a vitamin-mineral mix.

Management

Llamas and alpacas rely on the companionship of other animals to thrive. Both llamas and alpacas may be kept together and may also be kept with other herd animals. It is important that they are not kept alone because they are social animals that are best kept as family groups. They are most often placed with other small livestock because they protect the herd from predators.

Llamas and alpacas are reasonably easy to handle and easy to train. They are naturally curious and smart, and respond well to training. However, llamas and alpacas do not respond well to physical punishment. Every animal has a different personality. Careful consideration of the behavior of an animal should be regarded before purchasing the animal.

Although considered a hardy and healthy animal, in areas where temperatures go above 90°F (32°C), animals should be kept as cool as possible. Methods include providing shade and shearing the animals. Since both alpacas and llamas love water, using a water hose, pool, lake, etc., can be used to help keep the animals cool.

Reproduction

Female llamas and alpacas may be bred at one-and-a-half to two years of age; they do not have estrus cycles and are considered induced ovulators. Induced ovulation takes place while mating. When the female is ready to mate with the male, she lies down on the ground in a position called a **kush**. The kush position is when the female lays on the ground with her legs underneath her body. The male then mounts and breeds the female. While mating, the female releases the egg for fertilization. Llamas have a gestation period of about 350 days, and alpacas 335 days. Males do not reach sexual maturity until around three years of age.

kush

position in which an animal lays
on the ground with their legs
underneath their body



©Stockphoto/Marco Maccarini

FIGURE 38-4

A llama cria.

berserk male syndrome

aggressive behavior of llamas and alpacas toward humans due to over socialization with people

did you know?

The Spit Test: A pregnant llama or alpaca female will spit at a male to let him know she is pregnant and that she has no interest in mating. Llamas and alpacas may also spit on intruders in their territory. Llamas are more likely to spit at humans than are alpacas. Llamas and alpacas spit to protect themselves and to establish dominance in the herd.

Both llama and alpaca newborns are referred to as crias (Figure 38-4). Dams will usually only give birth to a single cria per year. Twins are rare.

Crias may be weaned after about six months. They should receive colostrum milk the first day of life. If bottle feeding is necessary, do so minimally. Bottle-fed crias tend to develop **berserk male syndrome**. Crias that are handled too much or bottle-raised become over-attached to humans and see them as fellow llamas/alpacas. It may start out as cute and fun, but as the animal becomes older, their aggressive behavior becomes rougher and may include chest-bumping, biting, and spitting. This usually results in the euthanization of the animal.

Health

Llamas and alpacas may become infected with the same parasites that affect other livestock. If internal parasites become a problem, animals should be wormed one to two times a year. No vaccines have been specifically developed for llamas and alpacas. Veterinarians often use vaccines designed for other animals.

To avoid health problems within the herd, have new animals examined by a veterinarian before bringing them into the herd. Animals being bought and sold should have a certificate of health. New animals should also be kept separate from the herd for a period of 30 days so they can be observed for any signs of disease or parasites.

Housing and Fencing

Shelter should be provided to protect llamas and alpacas from extreme temperatures and wind. In areas where the climate is mild, the animals require little or no housing. A shade structure or a three-sided run-in barn provides sufficient shelter in most cases.

Llamas and alpacas are clean animals and prefer to use a communal area for feces. A fresh, clean supply of water must be provided to the animals. Feeding animals from hay mangers or feed bunks will protect the feed, and help prevent parasites from being picked up off the ground. A variety of fencing material may be used, including electrical fences. Barbed wire should be avoided, as it can injure animals. Fencing should be 5 feet tall to help protect the animals from predators.

Summary

There is a growing interest in the llama and alpaca industry in the United States. Llamas and alpacas are used mainly for fiber. Llamas are also frequently used as pack animals. Llamas and alpacas are used for meat in South America. Both animals are modified ruminants with a diet consisting mainly of pasture, hay, and other roughages. Llamas and alpacas are relatively intelligent animals, and respond well to training. However, they generally do not like being touched. Owners should avoid bottle-raising crias due to the risk of berserk male syndrome. Health problems and treatments are similar to those of other livestock. The housing requirements for these animals are simple and similar to the housing used for sheep and cattle.

Quick Facts

- Llamas and alpacas are closely related to each other, and to camels.
- Alpacas and llamas are used for breeding stock, fiber production, pets, and pack animals.
- Mature llamas weigh 280–450 pounds while mature alpacas weigh 120–180 pounds.
- There are two types of alpacas, Huacaya and Suri.
- Both llamas and alpacas range in colors from shades of white to red to brown to black.
- Newborn llamas and alpacas are called crias.
- Llamas and alpacas are induced ovulators.
- The gestation period for llamas is 350 days and 335 days for alpacas.
- A dam will generally produce one cria per year.
- Llamas and alpacas are cud chewing, modified ruminants with a three-compartment stomach.
- Pasture and hay are the primary food sources for alpacas and llamas.
- Both llamas and alpacas can be raised on marginal pasture land.
- Llamas and alpacas are herd animals and do not like isolation.
- Llamas and alpacas are very intelligent and trainable, but many do not like to be touched.
- Llama and alpaca health concerns are the same as those for common herd animals.
- Llamas and alpacas require little shelter in mild temperatures.

Student Learning Activities

1. Obtain and examine clothing made from the fiber of llamas or alpacas.
2. Have someone who raises llamas or alpacas speak to the class.
3. Prepare and give an oral report to the class on any aspect of raising llamas or alpacas.
4. Prepare and present a poster to the class on llama and alpaca production. Additional research can be obtained from websites.
5. Use the information discussed in this chapter when planning and conducting a llama or alpaca Supervised Agricultural Experience (SAE) program.

Discussion Questions

1. What are the uses of llamas and alpacas in the United States?
2. Describe the characteristics of llamas and alpacas.
3. Discuss the feeding of llamas and alpacas.
4. Discuss reproduction of llamas and alpacas.
5. Discuss the spitting behavior of llamas and alpacas.

Review Questions

True/False

1. Llama and alpaca newborns are called calves.
2. Llamas and alpacas are herd animals.
3. Llamas and alpacas are modified ruminants.
4. There are approximately 20,000 llamas in the United States.
5. Llamas make good livestock guardians.

Multiple Choice

1. Llamas and alpacas are most closely related to:
 - a. horses
 - b. camels
 - c. cattle
 - d. zebras
2. Llamas and alpacas produce one cria per year, with the gestation period being _____ days for llamas.
 - a. 235
 - b. 250
 - c. 335
 - d. 350
3. The main sources of income in the United States from llamas and alpacas are:
 - a. backpacking and live sales
 - b. backpacking and fiber
 - c. fiber and live sales
 - d. fiber and meat

4. Kush is the proper position for _____.
 - a. breeding
 - b. eating
 - c. standing
 - d. giving birth
5. There are two types of alpacas, the _____.
 - a. Suri and Hindu
 - b. Harushku and Sadi
 - c. Suri and Huacaya
 - d. Sadi and Huacaya

Completion

1. A _____ is a newborn llama or alpaca.
2. As pack animals, llamas and alpacas can carry about _____ of their body weight.
3. When a llama or alpaca is hand-raised, it can become _____ towards humans.
4. Llamas and alpacas are _____ ruminants.
5. Llamas were first imported to the United States in the late _____.

Short Answer

1. What is the ILR? What do they do?
2. What is the AOBA and what do they do?
3. What is the size difference in llamas and alpacas?
4. What are the types of alpacas?
5. What is berserk male syndrome?

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Glossary



- abomasum** true stomach in ruminants; partially digested food mixes with gastric juices to complete digestion.
- accelerated lambing/kidding** a production system in which sheep and goats give birth more frequently than once per year.
- ad libitum** a system of feeding livestock in which no limit is placed on feed intake.
- afterbirth** the placenta and other membranes expelled after the birth of the fetus.
- agrosecurity** a type of biosecurity in which agricultural plants and animals are protected.
- agroterrorism** a specific type of bioterrorism in which the agricultural industry is directly targeted.
- air cell** air pocket found at the top of an egg.
- allele** a gene that, when paired, codes for a different characteristic of the same trait.
- all-in/all-out** moving animals as a group through each stage of production, generally with pigs.
- alveoli** the structures in the udder that convert nutrients into milk.
- American Rabbit Breeders Association (ARBA)** an organization that registers and sanctions rabbit shows and breed organizations.
- amino acid** organic compound containing carbon, hydrogen, oxygen, and nitrogen; compound that is the building block of proteins.
- amphibian** a cold-blooded animal with moist glandular skin; toes lack claws.
- anaerobic** without oxygen.
- anatomy** the study of the structure, shape, and form of organisms.
- anemia** a deficiency of iron in the blood.
- animal rights** the desire to end all human exploitation of animals, especially for food, but may

include captive animals, guide dogs for the blind, and owning animals as pets.

- animal science** the scientific study of animals for work, food, medicine, companionship, and other consumer goods.
- animal welfare** emphasizes the humane treatment of animals held for research, production, and other uses.
- anthelmintic** medication to kill worms.
- anthrax** an acute infectious disease caused by a spore-forming bacteria.
- antigen** anything that stimulates an immune response.
- arachnid** an eight-legged insect.
- artery** a blood vessel that carries blood away from the heart.
- artificial insemination** the placing of sperm in the female reproductive tract by other than natural means.
- asexual reproduction** production of an offspring by a single parent.
- asphyxiating** obstructing normal breathing causing unconsciousness or death.
- associate's degree** a two-year degree that provides training and specialization (e.g. Associate of Applied Science (A.A.S. or A.S.).
- avian influenza** flu caused by a virus that affects birds and humans; also known as bird flu.



- bachelor's degree** a four-year degree in a particular field of study.
- backfat** standard measurement of body fat in swine.
- balance** structure and proportion of the animal's body.
- banding (flocking) instinct** tendency of sheep to stay together in a group called a band or flock.

barrow a male pig that was castrated before sexual maturity.

battery cages a system of cages, which are often stacked, for housing birds that are layers.

beefalo an animal that is a cross between bison and domestic cattle.

berserk male syndrome behavior of bottle fed crias that become too attached to humans resulting in aggression and dangerous behaviors.

biosecurity protecting living things from biological harm such as diseases, pests, and bioterrorism; in agriculture, this is sometimes referred to as agrosecurity.

biotechnology the modification of living organisms to produce a more desirable product.

bioterrorism the deliberate use of biological or chemical weapons; in agriculture, this is sometimes referred to as agroterrorism.

biped walking on two legs.

bitch a female dog.

black-leg bacterial disease in cattle affecting mostly younger animals.

blemish an imperfection that does not affect the usefulness of the horse.

blind quarter a quarter of the udder that no longer produces milk.

boar a male pig that has not been castrated.

boar taint an objectionable flavor and odor in the pork of boars.

body condition score (BCS) a numerical scale that describes the overall condition of the animal's body.

bolt a sudden unpredictable action of running.

Bos indicus a species of beef cattle that is heat tolerant and disease and insect resistant; this species originated in tropical areas; also known as Zebu.

Bos taurus a species of beef cattle with European origins that thrive in temperate regions.

bovine somatotropin (BST) a hormone produced naturally in the pituitary gland that helps to regulate the ratio of energy that is used for milk and fat production.

bovine spongiform encephalopathy (BSE) a disorder affecting the central nervous system of cattle; also known as mad cow disease.

bovine viral diarrhea virus (BVDV) a highly contagious, often hard to recognize viral infection in cattle.

breed a group of animals similar in appearance, characteristics, and disposition; animals developed from the same bloodlines.

breed standard a set of six factors that describe the characteristics of a particular breed: color, shape, wool, hair, fur, and type.

broiler a large-breasted chicken used for meat production.

brood animal an animal that is kept for the purpose of breeding.

broodmare a female horse used for breeding.

browse the leaves, shoots, and twigs of shrubs, vines, and small trees.

brucellosis a highly contagious bacterial disease in goats, hogs, cattle, etc. causing abortion, infertility, and low milk production.

buck a male goat, sheep, rabbit, deer, or antelope.

bulk purchasing supplies, feed, etc. in large quantities, usually at lower prices.

bulk tank stainless steel tank that holds the milk on a dairy farm until pickup.

by-product animal parts used in a manner that is secondary to the intended or original use.



candling use of a high-intensity light to determine the interior quality of an egg.

cannibalism the practice of an animal eating the flesh of its own kind.

capon castrated male chicken.

captive animals animals kept in zoos or wild animal parks.

carbohydrate organic substance occurring in foods; there are four types: sugars, starches, cellulose, and lignin; can be broken down by animals for energy.

carcass merit the qualities of the carcass when the animal is harvested, which is expressed by yield grade and quality grade.

cardiac muscle striated involuntary muscle found only in the muscular wall of the heart.

career pathway a broad group of careers that share similar characteristics and educational requirements.

carnivore animals that primarily eat meat and meat products.

carotene natural yellow pigment found in animal tissue and certain plants.

carousel a rotating milking parlor.

cartilage tough, flexible connective tissue.

castrate removal of male sex organs.

cecum a large pouch in the large intestine of certain animals which is the site of the digestion of cellulose plant fiber through the process of bacterial fermentation.

cell the building block of an organism.

cell membrane the structure that encloses the cell.

chevon goat meat; also known as cabrito.

chick baby chicken.

chicken fancier someone who raises chickens as a hobby.

chromosome material in the nucleus of a cell that determines hereditary characteristics.

chronic wasting disease (CWD) a serious, contagious neurological disease of deer and elk which causes small lesions on the brain that cause loss in body condition, abnormal behavior, and death.

class (poultry) geographic origin of the poultry.

Clean Water Act legislation regulating water pollution; prohibits release of contaminants into a stream or river.

clipping trimming the hair of an animal.

clone an organism that is genetically identical to its parent.

closebreeding breeding of closely related animals that can be traced to more than one common ancestor.

closed registry an animal registration system that is closed to outside genetics; any animals whose ancestry cannot be traced back to the beginning or closing of the registry are not allowed.

coccidiosis diseases caused by protozoans of the order Coccidia.

coccidiostat chemicals that are added to feed or water that control protozoans of the order Coccidia.

cock mature male chicken; also known as a rooster.

cockerel male chicken under a year old.

codominance a genetic occurrence when neither allele dominates the other, nor both are fully expressed.

cold-blooded (horses) having a stable, calm temperament; strong and rugged.

colic a digestive disorder usually caused by a blockage in the intestine.

colostrum first milk from the mother after birth; this milk is rich in antibodies and minerals.

commercial cattle cattle raised for the purpose of producing meat.

companion animal an animal kept for enjoyment and companionship.

composting a natural process used to break down organic materials in an aerobic setting.

concentrate feed that is high in energy and contains less than 18% crude fiber.

conformation the type, form, and shape of the animal, usually with reference to some performance characteristic.

convenience food commercially prepared food that can be consumed with little to no preparation by the consumer; also known as processed food.

coprophagy the act of an animal eating its own feces.

counteractant a product that neutralizes odor.

creep feed a feed that is given to young animals as a supplement before weaning to reduce the stress of stopping their milk diet.

cria baby llama or alpaca.

crop a small pouch attached to the esophagus of birds that stores food.

crossbreeding mating animals of different breeds.

cull to remove an undesirable animal from the herd or flock.

cycle running an aquarium with all filters and components in place for a period of time before fish are added.

cytoplasm the substance of the cell outside of the nucleus.



dairy cooperative a business owned, operated, and controlled by dairy producers; used especially to market the milk produced by co-op members.

Dairy Cow Unified Scorecard a card that outlines the ideal standards for evaluating a dairy cow.

Dairy Herd Improvement (DHI) a program that tracks feeding, reproduction, health, and production of every cow in the herd.

Dairy Herd Improvement Association (DHIA) an organization that provides production testing services to dairies.

dam the female parent of an animal.

de-claw the removal of the cat's claws; often done to prevent scratching.

deficiency lack of a nutrient in an animal's system.

deodorant a chemical product that kills bacteria that cause odor.

deoxyribonucleic acid (DNA) the genetic material that determines the characteristics of an organism.

designer breed a planned crossing of two purebred animals to produce desired characteristics in the offspring; a common practice with dogs.

dewclaw rudimentary or primitive first digit in animals.

dewlap skin under the throat.

diet the type and amount of food and drink habitually ingested by a person or an animal; ration without reference to a specific time period.

digestion the breakdown of food into simple substances that can be absorbed by the body to fuel the body's cells.

digestive deodorant bacteria that create a digestive process that eliminates odor.

diploid a cell that has two sets of chromosomes, one set from each parent.

disposition the manner in which the animal acts or behaves.

doe an adult female goat, rabbit, or deer.

dog fighting an illegal activity in which dogs are trained to fight other dogs.

domestic an animal living in close proximity to humans; an animal that is tame.

domestication adaption of the behavior of an animal to fit the needs of people; bringing animals under the control of humans.

dominant gene a gene that hides the effect of the gene it is paired with.

donkey an animal that resembles a horse, only smaller in size with longer ears and an erect mane.

draft animal an animal that is used for pulling loads.

drenching oral administration of a liquid medication.

dry cow a cow that is not currently producing milk.

dual-purpose more than one purpose; an animal that is useful for producing more than one product.

dun a dull, brownish color.



egg white the substance that surrounds the egg yolk.

embryo transfer the placement of embryos from one cow into another female that will carry the developing calf until birth; the process in which embryos are taken from a superior donor animal and implanted into another animal for development.

endurance riding (horses) riders compete on a 25, 50, or 100 mile or more course for the best completion time.

entrepreneurship the practice of starting a new business or organization in response to a recognized need or opportunity.

environment the conditions in which an animal is raised.

Environmental Protection Agency (EPA) federal agency in charge of regulating environmental policies.

environmental stewardship - the responsible use and care of environmental resources.

enzyme a substance that acts as a catalyst in a biochemical reaction; has the ability to speed up digestion.

Eohippus an early ancestor of the domestic horse.

estrous cycle the reproductive cycle in most mammals that is measured from the beginning of one heat cycle to the beginning of the next.

estrus the time during which the female will accept the male for mating and is able to conceive.

euthanize the practice of inducing humane death in an animal.

exotic animal an animal that is not traditionally raised as a production or companion animal.

expected progeny difference (EPD) a measurement of the degree of difference of the progeny of a male to the progeny of the average male of the breed; an estimate of the genetic value of an animal in passing its traits to its offspring.



farm flock production the raising of small flocks of sheep that are usually kept on better pasture and may be fed grain and other supplements.

farrier a professional who cares for the hooves of horses.

farrow to give birth; the act of giving birth to a litter of pigs.

farrow-to-finish an operation in which sows give birth to pigs that are then raised to market weight on the same farm or by the same producer.

Clean Air Act legislation that regulates air quality standards.

feed additive substance added to animal feed to promote growth and health.

feed efficiency the ratio of pounds of feed consumed per pound of weight gained; also known as feed conversion.

feed tag label attached to a bag of commercial feed that lists the ingredients found in the feed.

feeder pig producer an operator that produces and sells young pigs to finishing operations.

feedlot a type of farm in which animals are grouped in lots and fed to finish them for harvest; a common term used in cattle finishing operations.

feedstuffs ingredients in the diets of animals, including flavoring and preservatives.

feral wild, not domesticated.

fermentation process by which bacteria convert carbohydrates into alcohols and acids.

fertilization process of a sperm cell uniting with an ovum (egg).

fetus unborn animal that is still developing in the mother's womb.

finish the degree of fat on an animal; often used interchangeably with condition.

finished cattle or fed cattle cattle raised to an appropriate weight for harvest.

finishing the increased feeding of an animal before harvest to increase weight and improve carcass quality.

finishing operation an operation where feeder animals are raised to market weight.

fitting the training and grooming of an animal in preparation for a show.

flea dirt the feces of the adult flea.

fleece the wool of one sheep or the wool of a similar animal.

flight zone the area surrounding an animal that when entered will cause the animal to retreat and flee.

float an instrument used for filing an animal's teeth; can be either a hand tool or connected with an electric device.

fluid milk milk or milk products in liquid form intended for drinking purposes.

flushing to increase the amount of feed for a short period before breeding to stimulate the ovulation rate of the animal.

folivore an animal whose diet consists largely of leaves.

foot-and-mouth disease a highly contagious and deadly viral disease of cloven-footed animals such as cattle, sheep, and swine.

fortify to add nutrients to a product.

founder inflammation of the hoof caused by a nutritional disorder that results in lameness of the animal.

frame score a measurement of a calf to estimate the mature size of the animal.

freestall barn a housing system in which animals may enter and leave a stall whenever they want; also called a loose barn.

fryer a young rabbit between 8 and 12 weeks of age.

furball a clump of fur ingested by the cat during grooming that is not able to pass through the digestive system.



gait the movement of the feet and legs when a horse is in motion.

gallinaceous heavy bodied, ground feeding birds that generally fly only short distances.

Gallus gallus a wild jungle fowl that originated in India.

game birds birds, such as quail, duck, and pheasant, that are hunted for sport.

gamete a reproductive cell.

gelding a castrated male horse.

gene a unit of DNA that gives an individual its traits.

gene pool the complete collection of genetic information for a group.

genetic disorder a health problem, caused by a defect in the genes, that can be passed from parent to offspring.

genetic engineering the process of identifying and transferring a gene or genes for a specific trait from one organism to another.

genetic potential the point at which an animal's production will stop increasing no matter what other factors, such as feed, are increased or improved.

genetically modified organism (GMO) an animal, plant, or micro-organism that has been modified by genetic means.

genetics the study of how traits (or characteristics) are passed from the parents to the offspring.

genotype the combination of genes an individual possesses.

gestation crates a device that houses a sow from breeding till farrowing.

gilt a young female pig that has not yet given birth and is not showing signs of pregnancy.

gizzard a muscular organ in the digestive system of birds that grinds food for digestion.

gland cistern the milk storage structure of the udder.

grade A milk milk produced under the most strict FDA sanitation regulations for dairies.

grade animal an animal not eligible for purebred registry.

grade B milk milk used in making cheese and other dairy products; production standards are not as high as those for Grade A milk.

grade horse an unregistered; non-purebred horse.

grading up improving the herd by mating high quality sires to grade females.

greenhouse gas an atmospheric gas that absorbs and emits heat.

grit small particles of granite used in poultry rations to help with grinding the feed in the gizzard.

ground training teaching a horse to wear a halter, lead, tie, and longe.

growth potential the ability of an animal to grow.



halter a rope, leather, or chain device with one loop placed behind the animal's ears and another loop around the nose for leading or restraining.

halter breaking the process of training an animal to be led on a halter.

haltering teaching a horse to accept that the handler is in control by putting a halter on the horse.

hand a measuring standard (4 inches) used in the equine industry to describe the height of horses, ponies, and other equines.

hand breeding when a handler assists in the breeding process of the stallion and the mare; the owner or handler stands with the mare, usually in a breeding stall, and the stallion is brought in

and allowed to mount the mare in a controlled environment.

haploid a cell containing a single set of chromosomes, half the number of chromosomes of a normal cell.

hare a type of lagomorph that gives birth to fully furred kits.

hatchery a facility where eggs are hatched under artificial conditions.

health certificate a document from a veterinarian stating that an animal is in good health and can be transported from the farm, especially for livestock shows.

heartworms parasitic worms living in the heart of the animal, especially in dogs; the animal is infested by the bite or ingestion of a mosquito.

heat the period of time the female animal is receptive to the male animal for breeding; also known as estrus.

hemoglobin the red protein in red blood cells that helps transport oxygen and carbon dioxide.

hen mature female chicken or turkey.

herbivore animals that eat plants as the main part of their diet.

herdbook a recognized, official record of the ancestry of an animal breed which is kept by the particular breed association.

herding group AKC recognized group of dogs that was developed to move people or animals in groups.

heritability the ability of genetic traits to be transmitted from parent to offspring.

heritability estimate the likelihood of a trait being passed from parent to offspring.

heterosis the measure of the superiority of the offspring over the parents.

heterozygous a gene pair that carries two different genes for a trait.

hinny a cross between a male horse and a female donkey.

homeothermic warm-blooded animals that are able to maintain their own body temperature.

homogenization the process of breaking the fat globules found in milk into a smaller size so the cream does not separate from the milk.

homozygous a gene pair that carries identical genes for a trait.

hormone implant a device placed under the skin of an animal that delivers hormones to the animal.

hot-blooded (horses) an animal that is easily excited; used to describe the temperament of horses that have some Thoroughbred or Arab blood.

hound group AKC recognized group of dogs that was developed to hunt.

hutch small pens for housing animals, typically rabbits.

hybrid the offspring produced from crossbreeding.

hybrid pet a pet animal resulting from the crossbreeding of two breeds to create offspring with desirable characteristics from each parent.

hybrid vigor improvement in traits of offspring over the traits of the parents; also known as heterosis.



in vitro fertilization (IVF) the process of fertilizing an egg outside the body.

inbreeding the mating of genetically related animals.

incomplete dominance a genetic occurrence when each gene in an allele is only partially expressed.

incubate to sit upon (eggs) or use artificial heat for the purpose of hatching.

indigenous originating in a particular area.

induced ovulator an animal in which the release of eggs doesn't occur without the stimulation of mating.

infectious laryngotracheitis (LT) a virus that attacks the respiratory system, especially in chickens.

insectivore an animal that eats only insects.

intensive grazing periodically moving livestock from one section of a pasture to another; also known as rotational grazing.

introduced species an animal or plant species which is not native to an area, but is brought in purposely or accidentally.



jack male donkey.

Jacobson's organ a scent organ located in a cat's upper mouth, behind the front teeth, that helps the cat to smell.

jennet female donkey.

junior dairy shows shows only allowing young competitors, generally high school age and younger in 4-H and FFA.



ketosis a nutritional disorder of cattle and sheep.

kindle to give birth, generally refers to rabbits.

kit a baby rabbit or hare.

kitten a young cat.

kush the position of an animal, such as a llama, in which it lays on the ground with its legs underneath its body; also the position of a female camelid for breeding.



lactating producing milk.

lagoon a large holding pond used to store manure and promote decomposition.

lamb young sheep under 12 months of age.

lamb tube a textile body covering, sometimes made out of spandex, intended to keep animals clean before a show.

lanolin a greasy, yellow waterproofing substance secreted by the sebaceous glands of wool-bearing animals.

layer a bird used for egg production.

lean muscle tissue of the body; meat lacking in fat.

legume a family of plants such as soybeans and clovers that, with the aid of symbiotic bacteria, can convert nitrogen from the air into a form of nitrogen in the soil that can be used by plants.

light horse a horse used for riding, driving, and racing.

limited admission shelter a location that will only accept animals they deem adoptable; these shelters are also known as no-kill shelters.

linebreeding a form of inbreeding in which the animals being mated are more distantly related than in closebreeding, and their ancestry can be traced to one common ancestor.

lipid an oily organic compound; includes fats and oils.

litter a group of young animals, such as piglets and puppies, born at a single birth; material used for bedding.

livestock farm animals raised to produce milk, meat, wool, etc.; may also include poultry and equine.

longeing training a horse to perform various gaits at the end of a long rope.

loose housing a method for housing animals that allows them to move freely within a confined building.



maintenance cost the amount of money required for the care and upkeep of an animal.

mange an inflammation of the skin caused by a microscopic mite.

marbling the amount of fat intermingled with the muscle fibers of meat.

masking agent a product that covers up odors by introducing another odor.

mastitis inflammation and infection of the udder.

Material Safety Data Sheet (MSDS) an informational sheet prepared by the manufacturer of a chemical with all requirements for storage, use, handling, and safety clearly spelled out.

maternal breeding value (MBV) an estimate of how the daughters of a bull are expected to produce compared to other cows in a herd.

medicated feed any feed that contains one or more medications.

meiosis cell division that creates gametes (sperm or egg cells).

meow the vocalization a cat uses to communicate with humans.

micron a unit of length in the metric system that is one millionth of a meter.

milk fever a disorder caused by a shortage of calcium in the blood, usually in cows shortly before or after giving birth.

milking parlor the area where cows are milked.

miscellaneous group dog breeds that have yet to be fully recognized by the American Kennel Club.

mitosis division of cells which increases the number of body cells resulting in growth.

mixed breed an animal that is a mix of two or more breeds.

mixed grazing raising two different livestock animals together on pasture.

modified ruminant an animal with a three-compartment stomach.

mohair the long, silky hair from the Angora goat.

molting losing feathers and re-growing new feathers.

monoestrous an animal that has one or two estrous cycles per year.

monogamous an animal that has only one mate during the breeding season.

monogastric an animal with only a simple or one-compartment stomach.

mule a cross between a male donkey and a female horse.

multi-cellular consisting of many cells.

muscle a body tissue that allows movement; the meat of the animal.

muscling the meatiness of the animal; the measure of the amount or degree of muscle an animal has.

mutation a change in DNA.

mutton the meat of sheep over one year of age.

muzzle an item used to cover the mouth of an animal to prevent eating, biting, etc.

myoglobin the pigmented (red) oxygen-transporting protein found in muscle.



navel cord the cord attaching the baby animal to the mother's placenta.

nesting box an enclosed area where the doe rabbit will have the kits; also an area for hens to lay eggs.

neuter removing the reproductive capability of a male animal.

newcastle disease highly infectious respiratory disease of birds.

niche market a narrowly defined group of customers within a larger market.

nocturnal an organism that sleeps during the day and is active at night.

non-point source a source of pollution that is hard to trace.

non-ruminant an animal that has a simple one-compartment stomach.

non-sporting group AKC recognized group of dogs that was developed to be companion animals.

novelty something new and unusual.

nucleus the core of the cell that houses the genetic material (DNA).

nutrient chemical elements or compounds found in food that provide energy, promote growth, and allow for the maintenance of body functions.



- obese** very fat, overweight.
- omasum** third part of the ruminant stomach that grinds small amounts of feed.
- omnivore** an animal that eats both plant and animal materials.
- oocyte** an egg cell that will become an embryo upon fertilization by a sperm cell.
- open admission shelter** a location that will take almost all animals; however, due to space and housing restrictions, some animals may be euthanized.
- open show** an animal show in which participants of any age can compete.
- organ** grouping of tissues that perform a specific function (e.g. the heart).
- organ system** a group of organs that work together to carry out particular body functions.
- organic** raising a product free of chemicals and pesticides.
- organic matter** a decaying substance that originated from a once-living organism.
- osteon** the basic unit of bone that creates the hard, compact structure of the bone.
- ostrich** a large flightless bird native to Africa and Arabia; the largest bird in existence.
- outcrossing** mating of animals from different families but of the same breed.
- ovary** organ that produces eggs in female animals.
- overo** paint horse color designation; variably colored head markings.
- ovulation** the release of an egg from the ovary.
- ovum** female reproductive cell.
- oxidation** a chemical process in which molecules give up energy, in the form of electrons, to bind with oxygen.



- palatable** pleasing to the taste.
- parasitologist** a scientist who studies parasites.
- parthenogenesis** the ability of an egg to hatch without being fertilized by a male.
- parturition** process of giving birth.
- pasteurization** the process of heating milk to high temperatures to kill bacteria.

- patent** a legal document that gives exclusive rights to the inventor of a product for the use and sale of the product.
- Paylean®** premixed feed used in show pig rations; a feed mix additive used to increase muscle growth in pigs.
- pedigree** the record of a particular animal's ancestry; documentation that lists the registered names of an animal's parents, grandparents, and great-grandparents up to four or five previous generations.
- pelt** the skin of an animal.
- per capita** per person.
- performance pedigree** a tool that helps livestock producers determine which animals to keep as replacements; some analyze how much of the particular animal's genetics will be passed to subsequent generations.
- performance records** the data collected on each animal or herd of animals based upon performance.
- performance testing** collecting data on livestock in order to select the most productive animals.
- phenotype** the physical appearance or characteristics of an animal.
- photoperiodic** stimulated by light.
- physiology** the study of the functions of the body.
- placenta** fluid-filled membrane containing the fetus.
- point source** an identifiable source of pollution.
- polled** an animal naturally lacking horns.
- polygamous** an animal that has more than one mate during the breeding season.
- porcine stress syndrome (PSS)** a genetic disorder in pigs that can result in sudden death.
- Pork Quality Assurance Plus Program (PQA Plus)** an educational program for swine producers that emphasizes swine herd health and animal well-being.
- pose** positioning an animal to best show its traits.
- poult** young turkey.
- probiotics** beneficial microorganisms added to feed to improve digestion.
- production testing** measurement of a brood female's production by the performance of her offspring.
- progeny testing** determining the breeding value of a bull based upon the performance of its offspring.

prolapsed uterus a condition in which the uterus protrudes from the vulva.

protein a nutrient found naturally in plants and animals that is essential for the growth and repair of body tissues; an organic compound composed of amino acids.

protein skimmer a device used in an aquarium to remove harmful compounds and substances that can cause algae or pH upset of the tank.

protoplasm the living matter of a cell, includes the nucleus and cytoplasm.

proventriculus the true stomach in birds; produces enzymes that break down food.

pullet immature female chicken.

puppy a young dog.

puppy mill commercial dog breeding operations that run under substandard conditions.

purebred an animal that exhibits the preferred characteristics of the breed; results from generations of unmixed breeding.

Purebred Dairy Cattle Association (PDCA) an organization that sets the standards for various breeds of dairy cows.

purebred swine an animal belonging to one of the recognized breeds of swine that may be eligible for registration with the official breed registry.

pure breed a group of animals similar in appearance, characteristics, and disposition.

purr a soothing sound a cat makes.



quality in livestock judging, this references the refinement of the head, hide, bone, and hair of the animal.

quality grade the grade given to beef that indicates the eating quality of the meat.

queen female cat.



range production a type of production in which animals are raised in groups and are free to roam over large tracts of land; especially sheep and cattle.

ration the total amount of feed provided to an animal in a 24-hour period; daily food allocation.

ratite a large, flightless bird.

recessive gene the gene that is hidden when paired with a dominant gene.

recombinant bovine somatotropin (rBST) a genetically engineered duplicate of the natural hormone BST that is used to increase milk production in cows; created by splicing the gene controlling BST into DNA of bacteria.

red blood cell a cell that carries oxygen throughout the body and removes waste.

rendering plant a facility that converts parts of dead animals into usable products; also known as a rendering facility.

reptile a cold-blooded animal covered with scales or plates; clawed toes.

respiration a process in living organisms by which oxygen is brought into the body and carbon dioxide, along with water and other unneeded gases, is removed from the body.

ribonucleic acid (RNA) carries the genetic information needed to make proteins in cells.

righting reflex the ability of a cat to right itself and land on its feet when it falls.

ring steward person in a show ring that helps carry out the judge's instructions and assist with animal movement.

ripping cleaning an animal with only water.

rope halter two loops of rope, one placed over the nose, and one placed behind the ears; a device used to restrain an animal.

rotational grazing periodically moving livestock from one section of a pasture to another; also known as intensive grazing.

roughage feed that is largely made up of fiber; contains more than 18 percent crude fiber.

rumen the largest compartment in the ruminant stomach.

ruminant an animal that has a stomach divided into several compartments; a cud-chewing animal that has a forestomach that allows for the fermentation of ingested materials.



saliva substance excreted by glands in the mouth to aid in digestion.

salmonella a bacteria that causes gastrointestinal illness.

sclera the outer layer of the eye that encircles the iris.

scours a disease that causes diarrhea and typically affects young animals.

scur a growth that sometimes occurs after horn removal, at the same place where the horn was located.

seedstock animals held for breeding to produce offspring for market.

setting up to position or pose an animal for display in a show.

sex-selected semen the semen of an animal that is sorted so that only those sperm carrying genes to produce a male or female offspring are retained.

sheath navel flap; a protective covering of a part of an animal.

shipping fever or bovine respiratory disease (BRD) a respiratory disease caused by bacteria and/or viruses.

show stick device with a small hook on one end that is used to set an animal up for show.

showmanship the ability of the handler to show an animal off to its best advantage.

silage succulent, high moisture crops that are fermented and stored for feeding at a later date.

sire the male parent of an animal.

sire summary a comparison chart that allows for the evaluation of a bull for desirable traits that may be passed to his offspring.

skeletal muscle muscle that has dark bands that cross each muscle fiber; “meat” of farm animals; also called striated voluntary muscle.

skill the ability to do something particularly well, often achieved through practice, training, and experience.

smooth muscle unstriated muscle that surrounds the hollow, internal organs of the body; also known as smooth involuntary muscle.

smoothness a lack of roughness in the finish and bone structure.

somatic cells cells from the body such as white blood cells and cells from the mammary tissue.

sow a female pig that has given birth (farrowed) or is showing signs of pregnancy.

spay removing the reproductive capability of a female animal.

species a group of animals with many common traits.

sperm male reproductive cell.

split-sex feeding the system of feeding males and females separately.

sporting group AKC recognized group of dogs that was developed to assist hunters in the pursuit of game.

squeeze chute and head gate structures used to hold animals, especially cattle, while treatments are performed.

stag a male pig that was castrated after reaching sexual maturity.

stanchion barn a type of dairy barn in which each cow is confined to an individual stall; also called a tie stall barn.

staple fibers of the wool graded by length.

sterile inability to reproduce.

straightbreeding mating animals of the same breed and genetic background.

strain (poultry) a group of birds which have been bred for specific characteristics.

structural correctness the physical condition of the skeletal system or bone structure of an animal.

stud a male animal kept for breeding.

style and balance the way all the body parts of an animal blend together; the manner in which the animal carries itself.

superovulation the process of injecting a cow with a hormone that will induce the release of several oocytes during each estrous cycle.

surface water water sources, such as rivers, streams, and lakes, that are found above ground.

Sus scrofa European wild boar.

Sus vittatus East Indian pig.

switch the hair on the end of the tail of a cow or other bovine animal.

Symbol III the NPPC designation for the ideal market hog.

systemic insecticide a chemical that spreads internally throughout the animal's body or plant to reduce or eliminate infection from pests.



table eggs eggs produced for human consumption.

tack the riding equipment and accessories used with horses, including the harness, saddle, bridle, reins, and stirrups.

tail docking the practice of cutting off an animal's tail.

technical college a two-year college that offers programs focused on career training and education.

terminal show after showing in this type of show, the animal is sold for harvest.

terrier group AKC recognized group of dogs that was developed to hunt and kill small animals and vermin.

textured feed a ration composed of mixed grains where the ingredients vary in size and shape.

tissue grouping of cells that carry out a specific function.

tobiano paint horse color designation; head is marked in the same way as that of a solid colored horse solid, or with a blaze, strip, or star.

tom a male cat or a mature male turkey, which is also called a gobbler.

tovero paint horse color designation; has dark pigmentation around the ears, which may expand to cover the forehead and/or eyes; one or both eyes are blue.

toy group AKC recognized group of dogs that was developed for their small size and for companion animals.

tunnel ventilation a cooling method for poultry houses.

type the overall conformation of the animal; overall appearance of the animal.

type (poultry) the purpose for which the poultry will be used.



udder the mammary gland of the cow.

ultrasonics the science and application of high-frequency sound waves that may be used to measure fat thickness and loin eye area.

underline the underside of the belly that includes the mammary glands.

unicellular consisting of one cell.

unsoundness a defect that reduces the usefulness of the animal.



variety (poultry) a sub-classification of a species based on certain traits, such as color of plumage and comb type.

vein a blood vessel that carries blood to the heart.

velvet the fuzzy covering over the antlers of elk and deer before the antlers become hard, similar to bones.

venison the meat of deer and elk used for food.

vertical integration when one firm owns two or more steps of the production process, including production of inputs and distribution; also known as vertical coordination.

volume and capacity refers to the relationship between the length, depth, and width of an animal's body.



warm-blooded (horses) horses that exhibit the grace of the hot blood breeds and the strength of the cold blood breeds.

wether a castrated male goat or sheep.

whelp term used to describe the act of a female dog giving birth.

white blood cell a cell that protects the body from disease and foreign materials.

withdrawal period the time an animal must be taken off of any medication, especially antibiotics, before the animal is sent to market or used to produce milk.

withers refers to the area of the animal's body where the top of the two shoulder blades come together.

working group AKC recognized group of dogs that was developed to labor or work for humans.



yield the weight of the chilled carcass compared to the live weight; this is known as the dressing percent.

yield grade the percent of carcass weight in boneless retail cuts after the fat has been trimmed off; expressed as a numerical score of 1 to 5.

yolk the yellow part of the egg that provides nutrients to the developing embryo in a fertilized egg.



zoonotic disease a disease that can be transmitted from animals to humans, or from humans to animals.

zygote a fertilized egg cell.

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